

Aviation Week & Space Technology

75 Cents

A McGraw-Hill Publication

October 29, 1962

SPECIAL REPORT:

**Minuteman
Guidance
And Control**

First DC-8F Rolls Out



revolutionary new **single point resistance MICROWELDER**



WELDS 36-MIL WIRE ON 3-MIL CENTERS

- Metal-to-glass bonds • Metal-to-ceramic bonds
- Metal-to-semiconductor substrates • Bonds to angstrom thin film films • Portable—110-115 V, ac, 60 cycle operation

Provides reliable bonds...from printed circuits to molecular electronic functional blocks.

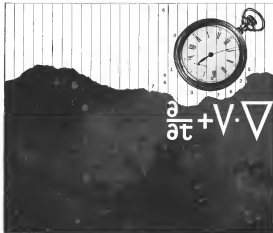
For further information write Aerojet General Corporation
Astronautics Division, Dept. 505, Azusa, California



WELDED
WINDOW FRAME
MICROELECTRONICS



ASTRONAUTICS DIVISION / AZUSA, CALIFORNIA



purposeful imagination....in time

The men of Aerospace apply the full resources of modern science and technology in a timely manner to achieve the continued advances in ballistic missile and space systems basic to national security. Their mission includes stimulating the flow of the most advanced scientific information and objectively planning the technical management programs necessary to generate superior systems in the shortest possible time. □ Channeled exclusively to serve the United States Government in this effort and acting in partnership with the Air Force-aerospace industry team, the men of Aerospace contribute: advanced systems analysis and planning; theoretical and experimental research; general systems engineering and corresponding technical direction of programs. □ To aid in reducing the timetable of advanced systems, from concept through completed mission, men with advanced degrees are needed at Aerospace Corporation, an equal opportunity employer. Distinguished interdisciplinary scientists and engineers who can contribute effectively are invited to contact Mr. Charles Lednicki, Room 101, Aerospace Corporation, 2 O. Box 35081, Los Angeles 43, California. □ Openness in the public interest and dedicated to providing objective leadership in the advancement and application of science and technology for the United States Government.





*Precision
Radar
and
Optical
Pedestals*

5 SECOND ANGULAR ACCURACY

TWO AND THREE AXIS MODELS

Here are some of the design features which have resulted in Reeves pedestals being selected for a number of current satellite and missile programs

- Gearless, direct drive dc torque motors on all axes
- Azimuth load bearing rated at 250,000 pounds
- Can accommodate reflectors to 30 foot diameter in redomes
- Tracking rates
From zero to 10 rpm in azimuth
From zero to 10 radian/second in elevation
- 36-speed pancake synchros provide analog readout (5 second accuracy)
- 17-bit encoders provide digital readout
- Complete Servo instrumentation

Such fast movement with no settling is essential for the high accuracy required in the tracking of satellites and missiles.



10 SPEED SYNCHRO

For your free copy of our new Catalog, describing the complete line of Reeves Pedestals, write for data file 712.

REEVES INSTRUMENT CORPORATION
A Subsidiary of Dynatron Corporation of America
Revere Field, Garden City, New York
4000

AEROSPACE CALENDAR

Nov. 85-Symposium on Protective Against Radiation Hazards in Space, Columbus, Ohio. Cosponsors: Oak Ridge National Laboratory, NASA, National Space Council, American Nuclear Society.

Nov. 85-Northeast Electronics Symposium and Engineering Meeting, Institute of Radio Engineers, Commonwealth Assembly, Somerset Hotel, Boston, Mass.
Nov. 5-14-68 Air Transport Management Institute, School of Business Administration, The American University, Washington, D. C.

Nov. 7-8-Symposium on Latin and Applications, Airlines Laboratory, Department of Electrical Engineering, Ohio State University, Columbus, Ohio.

Nov. 78-International Air Cargo Seminar, Doublet Plaza Hotel, Miami, Fla.
Nov. 10-Institute of the Aerospace Sciences, Society of Automotive Engineers.

Nov. 12-Wing Club Annual Dinner, Americans Hotel, New York, N. Y.

Nov. 12-15-International Air Transport Association Public Relations Committee, Sheraton Hotel, Washington, D. C.

Nov. 12-15-Signals Annual Conference on Magnetism and Magnetic Materials, in honor of Rudolf Eshbach, Penn-State Hotel, Pittsburgh, Pa.

Nov. 13-14-Retirement and Security Symposium, Imperial Hotel, Dayton, Ohio.
Nov. 14-15-American Institute of Aeronautics and Astronautics, Hughes Aircraft Company, Torrance, Calif.

Nov. 15-17-National Symposium on Materials Compatibility and Corrosion Control (Continued on page 7)

AVIATION WEEK and Space Technology

October 26, 1963

Vol. 37, No. 18

AVIATION WEEK and Space Technology is a leading authority on the latest developments in the aerospace industry. It covers all aspects of the industry, from the design and development of new aircraft and spacecraft to the production and operation of existing ones.

The magazine is published weekly, except for two issues which are published bi-monthly. It is a must-read for anyone involved in the aerospace industry, whether they are a designer, engineer, manufacturer, or operator.

The magazine is published by the Aviation Week and Space Technology Company, which is a subsidiary of the McGraw-Hill Companies. It is one of the most respected and authoritative sources of information in the aerospace industry.

The magazine is published by the Aviation Week and Space Technology Company, which is a subsidiary of the McGraw-Hill Companies. It is one of the most respected and authoritative sources of information in the aerospace industry.

The magazine is published by the Aviation Week and Space Technology Company, which is a subsidiary of the McGraw-Hill Companies. It is one of the most respected and authoritative sources of information in the aerospace industry.

The magazine is published by the Aviation Week and Space Technology Company, which is a subsidiary of the McGraw-Hill Companies. It is one of the most respected and authoritative sources of information in the aerospace industry.

The magazine is published by the Aviation Week and Space Technology Company, which is a subsidiary of the McGraw-Hill Companies. It is one of the most respected and authoritative sources of information in the aerospace industry.



**A Look Over the Trosson
at General Electric**

**fuel
cells**

NOVEMBER
1962

GE's fuel cells... They are burning with 60 fuel cells... (The text continues with a detailed description of GE's fuel cell technology and its applications in various industries.)

■ DOWNS THE HARDWARE KRA

There's a big difference between making a fuel cell, and producing fuel cells. We are now producing them.

Our new plant facility (the word is: knowledge) will produce fuel cells for manufacturing operations. Working these cells into our many chemical products is our goal.

The new facility's flow production is based on our long experience with pilot plant operations. It handles electrochemical reactions, electrolysis, and other chemical processes.

■ WHY WE'RE CONFIDENT ABOUT FUEL CELL SAFETY

The safety of fuel cells is a major concern. We have a proven safety record in the production of fuel cells.

Our fuel cells are designed to operate safely under all conditions. We have a proven safety record in the production of fuel cells.

Our fuel cells are designed to operate safely under all conditions. We have a proven safety record in the production of fuel cells.

Our fuel cells are designed to operate safely under all conditions. We have a proven safety record in the production of fuel cells.

Our fuel cells are designed to operate safely under all conditions. We have a proven safety record in the production of fuel cells.

■ POTABILITY: ON TRIAL BY

Hydrogen water from our fuel cells is of the highest quality. It is a must-read for anyone involved in the aerospace industry.

Hydrogen water from our fuel cells is of the highest quality. It is a must-read for anyone involved in the aerospace industry.

Hydrogen water from our fuel cells is of the highest quality. It is a must-read for anyone involved in the aerospace industry.

Hydrogen water from our fuel cells is of the highest quality. It is a must-read for anyone involved in the aerospace industry.

■ MEN AND MICE

Men and mice are both important in the aerospace industry. We have a proven safety record in the production of fuel cells.

Men and mice are both important in the aerospace industry. We have a proven safety record in the production of fuel cells.

Men and mice are both important in the aerospace industry. We have a proven safety record in the production of fuel cells.

Men and mice are both important in the aerospace industry. We have a proven safety record in the production of fuel cells.

Men and mice are both important in the aerospace industry. We have a proven safety record in the production of fuel cells.

Men and mice are both important in the aerospace industry. We have a proven safety record in the production of fuel cells.

Men and mice are both important in the aerospace industry. We have a proven safety record in the production of fuel cells.

Men and mice are both important in the aerospace industry. We have a proven safety record in the production of fuel cells.

Men and mice are both important in the aerospace industry. We have a proven safety record in the production of fuel cells.

Men and mice are both important in the aerospace industry. We have a proven safety record in the production of fuel cells.

Men and mice are both important in the aerospace industry. We have a proven safety record in the production of fuel cells.

Men and mice are both important in the aerospace industry. We have a proven safety record in the production of fuel cells.

Men and mice are both important in the aerospace industry. We have a proven safety record in the production of fuel cells.

Progress is Our Most Important Product

GENERAL ELECTRIC

nothing but talk...talk...talk...

LEACH SATELLITE RECORDER/REPRODUCERS are now in orbit storing lots and lots and lots of data . . . playing back when and where needed.

The unit shown here records on 1/4-inch Mylar-base magnetic tape up to 210 minutes at 1.6 ips . . . transmits back to earth in 8:07 minutes. As it transmits, it erases itself and records all over again.

Seven pounds light and seven inches narrow, this Leach Satellite Recorder/Reproducer has taken the rockiest launch

In stride, works in temperatures from -30°F to 130°F with an average power consumption of only 4 watts.

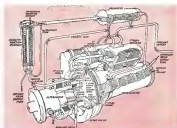
If you're in the satellite making business, you should make it your business to know more about this recorder/reproducer and how it can be adapted to your needs. You can know, too. Just send a line to Leach. You will get complete specs on this specially engineered recorder as well as other high environmental tape recorders—as the return mail.



LEACH
CORPORATION
2340 Bristol, Palo Alto, Calif.
Rm. 100, Leach International, Inc.

AEROSPACE CALENDAR

- (Continued from page 5)
- Nov. 14-15-16th Annual Meeting, American Society of Aerospace Engineers, Hotel New York, New York, N.Y.
- Nov. 18-19-20th Annual Meeting, American Society of Aerospace Engineers, Hotel New York, New York, N.Y.
- Nov. 21-22-23rd Annual Meeting, American Society of Aerospace Engineers, Hotel New York, New York, N.Y.
- Nov. 24-25-26th Annual Meeting, American Society of Aerospace Engineers, Hotel New York, New York, N.Y.
- Nov. 28-29-30th Annual Meeting, American Society of Aerospace Engineers, Hotel New York, New York, N.Y.
- Dec. 1-2-3rd Annual Meeting, American Society of Aerospace Engineers, Hotel New York, New York, N.Y.
- Dec. 5-6-7th Annual Meeting, American Society of Aerospace Engineers, Hotel New York, New York, N.Y.
- Dec. 9-10-11th Annual Meeting, American Society of Aerospace Engineers, Hotel New York, New York, N.Y.
- Dec. 13-14-15th Annual Meeting, American Society of Aerospace Engineers, Hotel New York, New York, N.Y.
- Dec. 17-18-19th Annual Meeting, American Society of Aerospace Engineers, Hotel New York, New York, N.Y.
- Dec. 21-22-23rd Annual Meeting, American Society of Aerospace Engineers, Hotel New York, New York, N.Y.
- Dec. 25-26-27th Annual Meeting, American Society of Aerospace Engineers, Hotel New York, New York, N.Y.
- Dec. 29-30-31st Annual Meeting, American Society of Aerospace Engineers, Hotel New York, New York, N.Y.
- (Continued on page 9)



A SENSIBLE WAY TO PROVIDE ACCESSORY POWER IN SPACE VEHICLES

This is the Sundstrand CRTHCYCLE . . . a cryogenic fuel, fully integrated power generation and thermal control system. Sundstrand developed the turbine drives CRTHCYCLE under a U.S. Air Force Systems Command contract. Powered by hydrogen and oxygen, the CRTHCYCLE is unique in that normally wasted heat from energy conversion turbochargers and even metabolic heat from the crew is recovered by the cooled loop and returned to the power cycle by interstage reheaters between each of the four stages of a stage-wise turbine. Sundstrand has also developed a multi-stage recuperating version of the CRTHCYCLE for low power levels. This concept results in specific fuel consumption economy which has been achieved by any other dynamic space power system. As a result, fuel weight and volume are reduced. In addition, the CRTHCYCLE operates at room temperature eliminating need for high temperature materials, solving wheel containment problems, and greatly improving inherent reliability and safety. Since the CRTHCYCLE is independent of the environment, it is ideal for lunar missions.

■ The CRTHCYCLE is a compact size, too. About the size of a popliteal bone power meter, it can be used in pairs for maximum reliability. ■ Several versions of this space power system are being developed which will be suitable for missions of several weeks' duration . . . at power levels from one kilowatt to 30 kilowatts. Both the turbine prime mover (shown) and the recuperating machine have been publicly demonstrated to representatives of the aerospace industry and government service. ■ (A simple request on your business stationery and we will send you details concerning this and the other accessory space power systems which Sundstrand has under development.) ■ If you would like to work on the Sundstrand Engineering team in the development of practical solutions to challenging space power problems, write to: Personnel Director,



SUNDSTRAND AVIATION • DENVER
A Division of Sundstrand Corporation
2480 West 70th Avenue, Denver 21, Colorado
SUNDSTRAND IS AN EQUAL OPPORTUNITY EMPLOYER



RAYTHEON'S NEW SPARROW III GOES AIR FORCE

Already the U.S. Navy's prime air-to-air missile system, Raytheon's Sparrow III has now been selected by the U. S. Air Force for use on its F-4C tactical fighter.

The advanced Sparrow III which will be used by the Air Force is the result of a growth program that has seen major improvements phased in since the missile was first conceived in 1951. These improvements include substantial increases in range, speed and altitude capabilities.

The new Sparrow III employs a unique target seeker which provides maximum attack flexibility under operational conditions. Once locked on the target, the seeker guides the missile to the intercept, constantly refining its aim as it closes on the enemy aircraft.

Sparrow III is further proof of Raytheon's ability to manage complex military systems — from early study through design, production and field support.

RAYTHEON

AEROSPACE CALENDAR

(Continued from page 7)

- Jan. 22-24—Ninth National Symposium on Reliability and Quality Control, Sheraton Hotel, Las Vegas, Nev.
- Jan. 26-Feb. 1—Fourth Annual Solid Rocket Rocket Conference, American Rocket Society, Bellevue Sheraton Hotel and The Franklin Institute, Philadelphia
- Jan. 26-Feb. 1—National Winter Conference on Military Electronics, Institute of Radio Engineers, Ambassador Hotel, Los Angeles, Calif.
- Feb. 11-12—Third International Symposium on Quantum Electronics, UNESCO Building, Paris, France. Sponsored by National Scientific Radio Union, Office of Naval Research, La. Federation Nationale Des Sciences Electriques
- Feb. 20-21—1961 International Solid State Circuit Conference, Philadelphia, Pa. Sponsored Institute of Radio Engineers, American Institute of Electrical Engineers, University of Pennsylvania
- Mar. 2—Astronautics Meeting, Secretary of the Airspace, Dayton, Ohio
- Mar. 21-23—Radio Propagation Conference, American Rocket Society, Colorado Springs, Colo.
- Mar. 14-20—Space Flight Testing Guidebook, American Rocket Society and Institute of the Aerospace Sciences, Cocoa Beach, Fla.
- Mar. 19-22—Second Air Transportation Symposium on Boston, Belmont Hotel, Dayton, Ohio
- Mar. 23-25—International Conference, Institute of Radio Engineers, Waldorf Astoria and Columbia, New York, N. Y.
- Apr. 13—Robert Annual Statistics and Materials Conference, American Rocket Society and Institute of the Aerospace Sciences, El Manser Hotel, Palm Springs, Calif.
- Apr. 15—Spring Conference, Airport Operations Council, Washington, D.C.
- Apr. 18-19—Fourth Symposium on Engineering Aspects of Magnetohydrodynamics, University of California, Berkeley, Calif.
- Apr. 19-19—International Molecular Magnetism Conference, Stanford Hotel, Washington, D.C. Sponsored American Institute of Electrical Engineers, Institute of Radio Engineers
- Apr. 19-19—Southwestern Conference and Electronic Show, Institute of Radio Engineers, Dallas Sheraton Hotel, Dallas, Tex.
- Apr. 19-19—National Meeting, National Association for Space Applications, American Rocket Society, Northbrook Hilton Hotel, Evanston, Ill.
- May 13-15—Third National Symposium on Human Factors in Electronics, Institute of Radio Engineers, Maxwell West, Bethesda, Md., Washington, D.C.
- May 17-19—Electronic Component Conference, Institute of Radio Engineers, Newport-Town Bridge Hotel, Washington, D.C.
- May 19-19—National Aerospace Electronics Conference, Institute of Radio Engineers, Dayton, Ohio
- May 20-21—National Telecommunications Conference, Hilton Hotel, Albuquerque, N. M.



THIS is

VACU-BLASTING

...the better way!



and, THIS is

VACU-BLASTING

...the better way!



and, THIS is

VACU-BLASTING

...the better way!

Vacu-Blasting is THIS method of blast cleaning which eliminates the mess, controls contamination at adjacent areas, speeds up production and saves you money. Want to know more about it? Write for a copy of our new illustrated brochure, "VACU-BLASTING...The Better Way!"

VACU-BLAST



COMPANY, INC., P.O. Box 885, Belmont, Calif.
 Dry Waxes, Vacu-Blasters® White Floor Buffers®, Vacu-Movers®

WITH THE VACU-BLAST GUN YOU CAN DO CABINET-TYPE BLASTING OUTSIDE OF THE CABINET! The unique Vacu-Blast Gun is so small a man's blast cabinet. Absorbs its blast through the nozzle and later on to the work. Abrasive is completely contained and after it has done its work, vacuum pickup returns it to the system for re-use.



Over the past 13 years we have reduced the size of our AC voltage regulator from a heavyweight



to a handful.

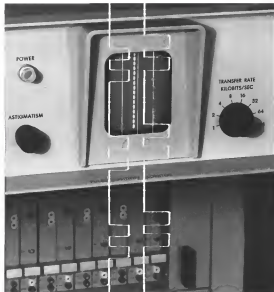
To be honest about it, we should say "less than a handful." But you get the idea. What was once a cumbersome piece of equipment now comes in a compact package that weighs exactly one pound. One pound!

These voltage regulators—for both aerospace and ground applications—are static, transistorized units containing no electron tubes. They are fully capable of

supplying all the necessary excitation of AC brushless generators (which we also happen to make) during both normal and fault conditions. We offer a complete line for any application.

We wrote a brochure to fill you in on all the details of our voltage regulators and brushless generators. Send for your free copy. Write us in Eatenstown, New Jersey.

Red Bank Division



Who makes true PCM recording come true?

AMPEX

You are looking at the newest PCM recorder designed to meet IRE standards—the CP-200. This is not an adaptation of an FM or analog system. It's a pure PCM machine especially designed to operate at 1000 bps (Maximum transfer rate: 120 Kc characters per second.) The CP-200 offers you this—and many other outstanding features. It has seven speeds, each electrically switchable from the front panel. It has a pulse position monitor and time

correction circuits to let you correct static errors caused by skew and gap wander. It has modular construction, plug-in amplifiers and heads. And it bears the Ampex name—your assurance of reliable, superior performance. For more details on the CP-200 write the only company providing recorders, tape and memory devices for every application: Ampex Corporation, 504 Charter St., Redwood City, Calif. Worldwide sales and service.

AMPEX



Predetection Recording by DCS gives you these 7 features:

- Best S/N performance • Best transient characteristics
- Up to 100,000 bit/second response • Tape speed compensation
- On-the-shelf modular flexibility • 100% solid state • Compatible with most receivers and transmitters

Considering predetection recording? Only DCS can give you all these advantages!

First, the phase lock loop design of the GFD-4 Discriminator permits playback at the recorded frequency without resampling the noise and transient degradation typical of up-conversion systems. And in addition, response from DC to beyond that required for 800 Mc/sec NRZ PCM is provided, far full 1800 requirements.

What's more, DCS has the only system providing tape speed compensation of reproduced data. Components are all solid state... modular (just plug 'em in!)... and available off the shelf.

Whether you need a complete predetection recording system, or want to build one using your present receiver and recorder (DCS components are compatible with most), DCS can help you.

Write us for complete information. Address: Dept. AM-2-7.

DATA-CONTROL SYSTEMS, INC.
Automotive for Research

Los Angeles • Santa Clara • Waltham, Mass. • Cape Canaveral

Puerto Rico • E. Liberty St. • Oakridge Station • Phoenix, Arizona



A OK! ARROWHEAD COMPONENTS A-OK NASA SATURN PROGRAM!

Reliability assured by complete in-plant facilities for design • engineering • testing • manufacturing • cleaning

Arrowhead capabilities in research, engineering and manufacturing are available for the solution of a variety of space age problems in the areas of metal, rubber, and plastic fabrication, thermal insulation and human factors.

CRYOGENIC
NON-
ISOLATED
O₂ LINES
ASSEMBLED
WITH
STAINLESS
BELLGWS



O₂ LINE

LOX LINE

O₂ & O₂ LINES

- Cryogenic line insulated
- Light Weight
- Thermal Growth Accommodated Through Integral Custom Designed Bellows Assemblies
- Restraint Provided by External Combs, Pin Joints and Bract Assemblies
- Tie Rod Restraint Also Offered
- Custom Vacuum Valve

- Cryogenic lines are insulated
- System of 32 Insulation
- Gaskets and slide joints provide complete spherical rotation

FLEXIBLE FLAME SHIELD CURTAINS....



TURBINE
EXHAUST
BELLOW
TIE ROD
ASSEMBLY

ENGINE SWIRL
COVER ASSEMBLY

Protect the NASA Saturn vehicle from intense radiated heat as well hot exhaust gases. System provides flexibility (engine and engine gaskets) and is able to withstand climatic elements, rigors of sea launch handling, various solvents, cleaners, fuels, redox and corrosion, bearing, pressure differentials, and severe shock and vibration.

Environmental Conditions Applicable to the Engine Swirl Cover Assembly are Similar to Those Described Above.

ARROWHEAD PRODUCTS

Division of Federal-Mogul Power Bearings, Inc.
 LOS ANGELES, CALIFORNIA

October 28, 1962

Aviation Week & Space Technology

Electro-hydraulic Servo Drives give "reflex action" to MAULER Launching Pod



Split-second response... directly stems up to three times the requirements to position the launcher for the drop's hot-firing, fast-moving, hot-field missile action called "MAULER," only a split-second prior power drive could do. TASC Corporation, which is developing the weapon pod, feels that kind of drive is electro-hydraulic servo system engineered and produced by Vickers Incorporated.

Vickers design approach in the required "reflex action" system was based on an approved manufacturing experience (production of over 100,000 electro-hydraulic servo pumps, for example) and found every inch engineering expertise during work by the beginning of World War II.

While the MAULER launching and servo-pump package represents a custom-built system, it is essentially a combination of standard Vickers components related to provide optimum performance for TASC's specialized application.

Here, then, is the unique advantage offered by Vickers Incorporated to any potential user of electro-hydraulic servo system: extensive design experience coupled with a broad line of ready-

hardware including components, assemblies, valves and related components.

On its base MAULER's electro-hydraulic servo drives offer the extra "reflex action" (the 300" sec.) On an instant, tracking reaction, Vickers servo drives provide acceleration of 800/sec² for reaction up to 7,000,000 lb. sec.²

High Drive... Applicable Response On another series of complex, rapidly moving action, Vickers electro-hydraulic drives offer Vickers Constant rate 100 sec. 1

Low Voltage-Voltage HP Rating Vickers and Vickers of Vickers servo drives have the minimum design. For example, a 20 HP electro-hydraulic servo pump is rated at 100 HP and has a torque ratio of 10 to 1.

Small Size-Small Wave Large Motion On many occasions, even against a load as low as 10 lb. with the primary and secondary control system up to 4,000,000 inch pounds.

MAULER is being developed for the United States Army by General Dynamics, Fort Worth.

VICKERS
DIVISION OF SPERRY RAND CORPORATION

Volume 37
Number 18

EDITOR: Robert M. Korte, Jr.

ASSISTANT EDITOR: William E. Brown

MANAGING EDITOR: William E. Brown

EDITORIAL BOARD: Robert M. Korte, Jr.

TECHNICAL EDITOR: David A. Anderson

EDITORIAL BOARD: Robert M. Korte, Jr.

EDITORIAL BOARD: Robert M. Korte, Jr.

EDITORIAL BOARD: Robert M. Korte, Jr.

EDITORIAL BOARD: Robert M. Korte, Jr.

EDITORIAL BOARD: Robert M. Korte, Jr.

EDITORIAL BOARD: Robert M. Korte, Jr.

EDITORIAL BOARD: Robert M. Korte, Jr.

EDITORIAL BOARD: Robert M. Korte, Jr.

EDITORIAL BOARD: Robert M. Korte, Jr.

EDITORIAL BOARD: Robert M. Korte, Jr.

EDITORIAL BOARD: Robert M. Korte, Jr.

EDITORIAL BOARD: Robert M. Korte, Jr.

EDITORIAL BOARD: Robert M. Korte, Jr.

EDITORIAL BOARD: Robert M. Korte, Jr.

EDITORIAL BOARD: Robert M. Korte, Jr.

EDITORIAL BOARD: Robert M. Korte, Jr.

EDITORIAL BOARD: Robert M. Korte, Jr.

EDITORIAL BOARD: Robert M. Korte, Jr.

EDITORIAL BOARD: Robert M. Korte, Jr.

EDITORIAL BOARD: Robert M. Korte, Jr.

EDITORIAL BOARD: Robert M. Korte, Jr.

EDITORIAL BOARD: Robert M. Korte, Jr.

EDITORIAL BOARD: Robert M. Korte, Jr.

EDITORIAL BOARD: Robert M. Korte, Jr.

EDITORIAL BOARD: Robert M. Korte, Jr.

EDITORIAL BOARD: Robert M. Korte, Jr.

EDITORIAL BOARD: Robert M. Korte, Jr.

EDITORIAL BOARD: Robert M. Korte, Jr.

EDITORIAL BOARD: Robert M. Korte, Jr.

EDITORIAL BOARD: Robert M. Korte, Jr.

EDITORIAL BOARD: Robert M. Korte, Jr.

EDITORIAL BOARD: Robert M. Korte, Jr.

EDITORIAL BOARD: Robert M. Korte, Jr.

EDITORIAL BOARD: Robert M. Korte, Jr.

EDITORIAL BOARD: Robert M. Korte, Jr.

EDITORIAL BOARD: Robert M. Korte, Jr.

EDITORIAL BOARD: Robert M. Korte, Jr.

EDITORIAL BOARD: Robert M. Korte, Jr.

EDITORIAL BOARD: Robert M. Korte, Jr.

EDITORIAL BOARD: Robert M. Korte, Jr.

EDITORIAL BOARD: Robert M. Korte, Jr.

EDITORIAL BOARD: Robert M. Korte, Jr.

EDITORIAL BOARD: Robert M. Korte, Jr.

EDITORIAL BOARD: Robert M. Korte, Jr.

EDITORIAL BOARD: Robert M. Korte, Jr.

EDITORIAL BOARD: Robert M. Korte, Jr.

EDITORIAL BOARD: Robert M. Korte, Jr.

EDITORIAL BOARD: Robert M. Korte, Jr.

EDITORIAL BOARD: Robert M. Korte, Jr.

EDITORIAL BOARD: Robert M. Korte, Jr.

EDITORIAL BOARD: Robert M. Korte, Jr.

EDITORIAL BOARD: Robert M. Korte, Jr.

EDITORIAL BOARD: Robert M. Korte, Jr.

EDITORIAL BOARD: Robert M. Korte, Jr.

EDITORIAL BOARD: Robert M. Korte, Jr.

EDITORIAL BOARD: Robert M. Korte, Jr.

EDITORIAL BOARD: Robert M. Korte, Jr.

EDITORIAL BOARD: Robert M. Korte, Jr.

EDITORIAL BOARD: Robert M. Korte, Jr.

EDITORIAL BOARD: Robert M. Korte, Jr.

SPECIAL REPORTS ON: DATA

SOVIET RUSSIA, AVOIDS FIRST ROCKADE SHOWDOWN..... 26

Photo Show: Soviet Missiles Being Unveiled..... 29

Mobile Medium-Range Soviet Missiles Identified in Photos..... 30

Photo Documented Cuban Arms Buildup..... 31

U.S. Alert Includes Machine Gun Tests..... 32

Chronology of Cuban Military Buildup..... 33

Supersonic Missiles of Anti-Aircraft Missiles..... 34

AIR TRANSPORT

U.S. WOULD ROCK SOVIET AIRPORT TO CUBA..... 41

TAA (Transportation Airport) Disaster Plan..... 42

Na Agreement Seen on IATA Cargo Rates..... 43

American Buys 4 Boeing 730C Freighters..... 44

Useability Key Point in L-300 Commercial Sales Effort..... 45

Brink Supermarine Transport Tests..... 46

Study Depicts Airline on Deficit Issue..... 47

Airline Observer..... 48

Shortlist..... 49

SPACE TECHNOLOGY

TECHNICAL REVIEW BOARD STUDIES RANGER FAILURES..... 50

Wide-Angle Camera Reports After Booster Separation..... 51

Large Graphite Nozzle Cylinders Formed..... 52

AERONAUTICAL ENGINEERING

GERMANS WEIGH CUTTING F117 SUPPORT..... 53

Conver 700A Has Wing, Prop, Nozzle Changes..... 54

Beta Aircraft Reveals First Design Details of Proposed BD-7 Airline..... 55

Production Briefing..... 56

MANAGEMENT

New York Post Defense Work Decline..... 57

Industry Observer..... 58

What's Wrong..... 59

AVIONICS

MAINTENANCE SYSTEMS KEYED TO FAST-REACT DEMANDS..... 60

Solar Radar to Track S-66 Satellite Next Year..... 61

Filer Center..... 62

BUSINESS FLYING

McGraw-Hill 2001 Has Rough Field Capability..... 63

Mooney Deploys Two New 1950 Models..... 64

SAFETY

BLAST CAUSED CONTINENTAL 707 CRASH..... 103

Load Not Used in Sea Rescue With Helicopter..... 104

New England Roundup..... 105

News Digest..... 106

EDITORIAL

The Cullen Crisis..... 21

EDITORIAL

EDITORIAL

EDITORIAL

EDITORIAL

EDITORIAL

EDITORIAL

EDITORIAL

EDITORIAL

EDITORIAL

EDITORIAL

EDITORIAL

EDITORIAL

EDITORIAL

EDITORIAL

EDITORIAL

EDITORIAL

EDITORIAL

EDITORIAL

EDITORIAL

EDITORIAL

Lockheed Ordnance Devices Perform in Outer Space or Undersea



Lockheed Electronics offers the military and industry a complete line of Ordnance and Pyrotechnic Devices for ground-level, outer space and underwater applications...including:

FLUID DISCONNECTS
Self sealing and adaptable to existing A-N-D fittings



ELECTRICAL DISCONNECTS
Available for most 24 & 36 Connections



PIN PULLERS/POWERS
Wide range of disconnects and terminals. Separate units for ground-level, outer space and 3-0 miles below the sea



EXPLOSIVE ACTIVATED VALVES
Open, close, and high flow rate dump valves



SAFE AND ARM INITIATORS
Circuitry, lightweight, Safe and Arm, ready for high explosive systems



Lockheed Ordnance Devices are "performance proven" on such projects as Ranger, Agena, Polaris and major Air Force Solid-Fire Programs. Undersea gas-pullers were developed under contract to the Stimpco Institute.

For Ordnance Devices with a wide range of performance characteristics write: Lockheed Electronics Company, Aviation & Industrial Products, 6201 E. Randolph Street, Los Angeles 22, California.

LOCKHEED ELECTRONICS COMPANY

Aviation & Industrial Products—6201 E. Randolph St., Los Angeles 22, California

A DIVISION OF THE LOCKHEED AIRCRAFT CORPORATION

EDITORIAL

The Cuban Crisis

The speed and firmness with which U.S. military power was applied to counter the threat of offensive nuclear weapons in Cuba was as heartening to the American people and their Allies as it was surprising to their foes. Establishment of the naval and aerial blockade to shut off the flow of Russian missiles and jet bombers to Cuba was certainly the most decisive reply to Soviet aggression since the Communist attempt to conquer Korea was repelled by armed forces of the U.S. and United Nations.

There are still several chapters to unfold in this Cuban crisis and it is premature to reach any firm conclusions yet. However, the initial Russian reaction is telling back a dozen of its Cuba-bound ships carrying offensive weapons, including the Polivna with a load of IRBMs, indicates the Soviets are wary of pressing their Cuban venture further in the face of U.S. military power. Certainly the next critical phase of the crisis—whether or not President Kennedy will come from the chair of methods by which the missiles and bombers already in Cuba are withdrawn or reduced in size.

Diplomatic Deceit

The summer in which the Soviets attempted to set up their nuclear missile base in Cuba should convince anybody that still needs to be convinced of the utter folly of accepting anything the Soviet leaders say at face value. For at the very time Soviet Foreign Minister Andrei Gromyko was sitting in the White House assuring President Kennedy that the Soviets had no intention of supplying Cuba with offensive arms, thousands of Soviet technicians were building MRBM and IRBM missile pads in the Cuban hills, and assembling twinjet II-28 bombers on Cuban airfields, and a stream of Soviet ships was sailing for Cuba with decksloads of IRBMs and other missiles and bombers. Not once the Japanese ambassador clattered with Cordell Hull while the bombs rained down on Pearl Harbor has there been such a callous exhibition of diplomatic deceit perpetrated on this nation. The speed and magnitude of the Soviet ballistic missile build-up in Cuba showed clearly that once again they hoped to pressure the U.S. with an aggressive but accomplish, and then use it as a lever to extend Soviet responsibility by the negotiating technique of an armed robber.

The Air Force and Navy pilots who flew the photo reconnaissance missions that exposed this Soviet build-up deserve great credit for the skill and courage with which they successfully executed these missions, winging from the extramile U-2 flights to the low-level oblique photo runs of Navy F8Us. The legions of skilled photo

interpreters that spotted and identified the vital missile installations are more among heroes of this and other episodes of the cold war's warmer phases.

With the incontrovertible evidence of Soviet deceit gathered by these pilots and photo interpreters, it was hardly to be seen in international significance with the U.S. government almost lost the total value of these pictures as establishing the validity of President Kennedy's case to even the most skeptical international observers. Some say words in the intelligence bureaucracy were mumbled that public release of these pictures would compromise "other" intelligence techniques, as though aerial photography was a major art known only to the druids of Langley Circle (Va.). President Kennedy's case would have gained even more impact if he had shown these damning pictures on television during his nationwide speech on October 22. But this powerful evidence was enshrouded by the petty bureaucrats in the intelligence system. The spectacle of Defense Secretary McNamara waving these pictures before a Pentagon press conference—which included Russian reporters—and then saying they were too secret for the American people to see is a vignette of official stupidity that will be hard to top. The American Embassy official in London who "unearthed" released them to the British press and television deserves his country's thanks and a medal, too, for breaking the bottleneck of bureaucratic stupidity and paving the way for this proof of Soviet perfidy to be plastered around the world.

Long Overdue Move

The Cuban blockade is just the first step in a process—which should have begun many, many years ago—of opposing the extension of Soviet imperialism wherever it attempts to extend its boundaries. It will require not only superior technical skill, such as the aerial reconnaissance techniques that unmasked the Soviet arms in Cuba, but also superior intelligence in their application and the determined strength of national will that cannot be balked or frightened into doubting the basic elements of a free society.

Because we have retreated so long in the face of this Soviet imperialism and because we have taken as long to recognize the stark, ugly outline of this threat, the road back will be longer and the toll along the way higher. But it is a road we must travel if the world is not to be enshrouded by a flood of ancient barbarity clothed in the modern political dogma of communism.

—Robert Hotz



One of the newest technologies being brought to maturity is the Apparatus division is the expanded application of semiconductor network circuitry to space exploration equipment. TI's approach improves reliability and simplifies circuitry — effectively extending equipment capability without increasing volume.

Here is one example: This seven-chute PCM digital data signal conditioner has the semiconductor network comprised of 256 components. Logic is performed by Solid Circuit's semiconductor networks—102 of them. This equipment has already been delivered to the Department of Physics and Astronomy at the State University of Iowa for an EGO astrophysics experiment.

— 臺灣省立美術館 2011 年 10 月 20 日—11 月 10 日 —



TEXAS INSTRUMENTS

1. 凡在本公司工作之员工，其工资由基本工资、绩效工资、奖金、津贴、补贴、福利费、社会保险费、住房公积金等组成。

In the Front Office

England, is production director. Mr. Hough is professor of managing director of Vickers-Armstrongs (Aircraft), Ltd., a subsidiary of BAC.

Harry B. Smith, executive manager of the Washington Defense Center, A

► Lockheed Propulsion Co. will deliver seven additional MC-18 high mass fraction (approximately 0.91) solid-propellant rocket motors to Air Force Space Systems Division, as a fourth stage for Blue Scout-Bravo from the Armory for Deep Space Probe Program.



... out of 22 years of ASW fire control system engineering

This is the ASROC fire control computer, symbolically efficient. In reality, this computer directs the fire of the U.S. Navy's anti-submarine rocket weapon system. It is the latest of eleven major Librascope contributions to ASW dating back to 1940. More than 90% of the



Underwater Fire Control Systems in the Navy's Anti-submarine Surface Flare today were designed and/or built by Librascope. Seafloor, surface, air and space. Librascope computers pace men's expanding mind. Send for "Librascope ASW Achievements 1940-1980"

LIBRASCOPE DIVISION
GP GENERAL
PRECISION

880 Western Avenue, Glendale 1, California

Circle 1

Washington Roundup

Crisis Information Plan

Kennedy Administration is trying to develop a satellite information policy to fit the security needs of cold war crises like the Cuban one without resorting to the degree of censorship imposed during a shooting war.

President Kennedy himself gave the impetus for such an effort by declaring in his Cuba speech that "no one longer lives in a world where only the secret firing of weapons signifies a sufficient challenge to a nation's security to constitute a national peril."

White House Press Secretary Pierre Salinger last week took the first step toward implementing a "crisis" information policy by issuing guidelines to news media as to the type of satellite information the Administration considers "confidential to the public interest." He contended the guidelines are not as far-reaching as the military censorship followed in wartime, but there is little apparent difference.

Salinger was particularly vocal about television interviews which tried to elicit from servicemen's wives such specific satellite information as ship and troop movements. The White House appeal to U.S. news media to "exercise caution and discretion" was to be followed up by discussions with foreign newsmen about safeguarding sensitive information.

The Administration is coupling its appeal to the press with strict rules about what satellite information Defense Dept. personnel can release. White House officials themselves consider the rules stringent. Immediate result of the new rules will be a clamp-down on all types of satellite information until Defense Dept. personnel feel sure one cannot walk into any one and extract any.

Production Stepup

Defense Dept. last week started calling on aerospace contractors to learn how fast they could increase production if the need arose. The calls attempted to reduce the chance that Defense officials would go ahead with more plans to phase out aircraft production in several areas.

Political considerations are increasing the likelihood that Defense will choose a second source for producing the McDonnell F-4B Phantom for the Navy and Air Force (F-4C). (AFM Sept. 24, p. 22). McDonnell contends it would be cheaper to increase production by letting the firm extend its subcontracting, assuming that 75% of the work on the aircraft already is subcontracted.

Employers Club has succeeded in getting more than 50 leaders of aerospace firms to sponsor a dinner in New York Nov. 2 for National Association and Space Administration Administrator James E. Webb and the astronauts. The \$100-a-plate dinner is held in the cafeteria at the defunctible. Part of the proceeds will go into the club's building fund.

NASA's Talent Hunt

For the first time, NASA is employing management recruiting firms in hopes of finding 10 research and development executives to supervise integration and system engineering for manned space flight program. NASA will pay the Los Angeles firm of Francis L. Louwage \$150,000 expenses and the New York firm of George Fox a bond fee of \$11,140. Both firms will submit lists of candidates and the space agency will choose 10 for positions paying \$10,000 to \$19,000.

U.S. and Japan are meeting agreement on the location and operation of a ground station in Japan to track, analyze and other communications satellites.

Major Gen. Alfred Stahler of the Army Engineers, former director of the Atomic Energy Commission's military applications division and now commander of Joint Task Force 1, conducting the current series of U.S. nuclear tests, has been named director of the Defense Civilian Research Agency. He will replace Rear Adm. W. D. Riva, who has headed the agency since its creation two years ago.

Cuban Refugee Airlift

Airlift of Cuban refugees who supplied vital information about the Soviet missile buildup on the island, ended last week when Pan American World Airways stopped service there (see p. 48). Pan Am, the last U.S. carrier to support Cuban exiles, flew more than 900,000 refugees from Havana to Miami since January, 1961. Another 50,000 Cubans were waiting to fly to Miami when Cuba ordered the airlift to halt.

Dissemination note: New York Post Authority refused to let two B-1H military carrying 100 Soviet missiles slated to appear in New York land at Midway unless the Russians provided information about engine noise. The Russians did not supply the information and landed in Philadelphia International Airport.

—Washington Staff



ILYUSHIN IL-28 fighter bombers are shown being unloaded, assembled and tested in this airfield in Cuba. Enlarged inset shows 16 crates containing MiG-19 subassemblies, three packages mounted and one completely assembled aircraft. Total of 16 MiG-19s have reached Cuba during past few weeks. Note one aircraft inside one of crates right of top photo. Installation of all glass type with six launch rails arranged around a control fin, on tail shock absorber. This is the second generation Russian turbine jet to be made with the N-100 only since Goshawk. Runways at the Cuban field have been extended and extensive disposal area built to protect the flightline. Russian ships carrying control deck loads of MiG-19 subassemblies are photographed by U.S. satellites (inset). Two B-52s heading center are visible on one ship they arrived in Cuba while boats deckload of control aircraft is shown on another ship headed for a Cuban port (below).



AREAS IN NORTH AND SOUTH AMERICA within range of Soviet bombers and missiles now operational or being delivered to Cuba are shown by the lines within map. B-52s range of 300 mi. from Cuba includes Cape Canaveral and Eglin AFB, Fla. Soviet medium-range ballistic missiles, now deployed in Cuba, have 1,000 mi. range shown in red dots, which includes Washington, D.C. Intermediate-range ballistic missiles, some of which are under construction, cover (dotted line) Midwestern AFB, Mo., where Air Minuteman complex is located, OHAF AFB, Neb., where Strategic Air Command headquarters and an Atlas missile complex are located; Lowry AFB, Colo., first operational Titan site; Fitchburg AFB, Kan., an operational Atlas and jet bomber base; Warner AFB, Wyo., operational Atlas site, and Fitchburg, N. Y., a jet bomber base and an Atlas site under construction. Range of the missiles extends outward in line as far, and covers all of Venezuela, Colombia and Ecuador.

ships," and left a clear impression here that invasion of Cuba could follow if it became necessary.

It is an extremely strong statement, President Kennedy said the U. S. would regard "any nuclear missile launched from Cuba against any nation in the Western Hemisphere as an attack by the Soviet Union on the U. S., requiring a full retaliatory response upon the Soviet Union."

Russia's refusal to sign a "no nuclear war" pact to the U. S. and said of "the aggression touch off a war, the Soviet Union would strike a most powerful retaliatory blow."

The statement said that "Whereas earlier the U. S. could regard itself as the strongest military power, it now has no foundation what over for this." The statement referred

to the blockade as "positive action."

In the hectic period before the President revealed the nature and seriousness of the Cuban crisis, he cancelled a political speaking tour related to the November elections and recalled Vice President Lyndon Johnson, cabinet members and congressional leaders to Washington. He later cancelled all campaign stops and speeches for himself, vice president and cabinet. He asked key congressmen to be ready to return to Washington on 8th night.

As Soviet ship courtesies and U. S. ships alerted their military forces, Bush, Texas, Senator Harold McCulloch told the House of Congress that Russia's missile buildup in Cuba was "a deliberate adventure designed to test the ability and determination of the

U. S." He said there "must be no break or wavering amongst the allies. That, perhaps, is the most purpose of the Russian initiative."

From another session to the blockade on Coast Britain was the sailing of the Palmer submarine missile Trident from a Scottish base. The Trident normally does not leave its anchorage. One Palmer missile carrying sub sailed directly before the Panama and five more sent by it already were at sea.

Finland, the last of the major allies to put its armed forces on alert, did not do so until Oct. 25. Finland was among a number of countries that let it be known unofficially that it did not appreciate being alerted of U. S. intentions only after a number of ships had already been taken in secret.



RIGHT TO TEN missile sites or reconnaissance facilities inside sites are in the line seen designated on the map island of Cuba. Any for further information could define missile on Cuba and the U.S. Air Force also an interest. Besides these, 24 missile bases inside sites are scattered over Cuba. Six are equipped with missiles and launchers based at Cuban airports and missile on the ground. MCMC AFB, Tampa Fl., F-16s AFB and MCMC AFB both near Cape Canaveral, and Key West, Fla., are some of heavy U.S. as active during tests. Also shown are major Naval bases at Guantanamo Bay in Cuba and Roosevelt Roads, Puerto Rico.

also includes "surface to surface missiles, homing, cruise, air-to-air, cruise, and cruise, missiles, missiles for use of the shore weapons, mechanical or electronic equipment to support or destroy the shore threat, and also other classes of missile launchers designated by the Secretary of Defense for the purpose of effecting this conclusion."

McNamara and the U.S. "are more anxious to believe that these [missile] sites are being constructed by Russians and that the surface-to-air missile systems are being acquired and operated by Russians, because they are highly technical and because they have not been tested and there has not been time to train the Cubans in their operation."

"It seems now clear that these are second-hand Russian in the field now performing military functions," McNamara said.

Comments for the MRBM are "aligned to a specific section of the U.S.," McNamara said. In the case of one launch site, where plans indicate that 24 hr. apart should a 50% increase in equipment, McNamara said. "This personnel are in an operational condition since that photo took first came to an attention, which was in June, that three or four days ago."

"So there has been a very rapid movement of missile MRBM to the sites and into the process of activation. How long that has been in Cuba, I can't say."

They have been tested in effectiveness before in the tests they began to move along the roads and move out into the open."

U.S. spokesmen have stressed the army and the readiness of the missile launchers. Never before, they said, has either Russia or the U.S. collected a

large of nuclear weapons either directly or rapidly enough to impact the balance of forces in an area—this because of a virtual first that do so might trigger a nuclear war.

Soviet MRBM—totaling 15 by early last week—have been involved in the recent buildup also, but they are a construction of an index of MRBM launchers of various types which began arriving in Cuba more than a year ago, and appear with, are considered a part of Cuba's defensive forces. Yet, number of MRBM at all types first reached 100 in early last week, State Dept. said.

State Dept., apparently, using the MRBM example referred to by McNamara, showed one picture with 45 to 50 vehicles and a few cars but no missiles or cannons. Another photo of the same site, taken 14 hr. later, showed some missiles, four cannons, 27 more vehicles of housing 500 men, and 100 vehicles.

"The pattern of very rapid deployment has been going on throughout Cuba," State Dept. spokesman said. "It has been retroactively said."

All the MRBM and IRBM sites are designed for repeated launches, and it's almost certain that they are available for at least a second salvo," State Dept. said.

The MRBM is the most new frequently paraded on track-down trails through Red Square in Moscow. It may have been the missile which set off the intense U.S. reconnaissance activity. A State Dept. spokesman showed one photo of a large picture of a missile launchers with a car at each end of the launch track, and said "With such missiles, you can launch it from its rail line at the Soviet 1,000-1000 missile. The

same, thing with the ground and landing equipment."

No IRBM sites were reported as of early last week, but activities were considered to be "a matter of weeks." McNamara said. Photos of some sites showed only, seen in the earth for placement of launchers, remains for cables between the launchers and the sites, etc. Others showed the sites "in a somewhat later stage of development."

McNamara pointed out that "it was not until mid-October (Oct. 21) that we got complete information." He said that most of Cuba was examined only in the week and the conclusion drawn first there were no obvious weapons there. The most recent were reconstructed in the work, "based on the information that became available gradually, and (we) concluded throughout the years of Sunday, warning that there were no missiles. These were detected when the pattern—the distances between certain specified objects appeared out and even again."

"You must recognize that this is a difficult job. Weather, clouds, the angle of the sun, the most amazing state photo efforts complicate the photo interpretation job," McNamara said.

McNamara said no U.S. reconnaissance aircraft had been launched down, but he would not say whether they had been shot at. He said he thinks it is possible to camouflage the missile sites "and I believe they could have done so during the construction period had they so chosen."

"I think that there is evidence first there was some activity with such missiles, and such state that they did not take the time necessary to camouflage."

Republic ph stainless steel helps keep Titan on target



Balanced on a 400,000-pound stream of thrust, a USAF Titan II ICBM cracks the cool Canaveral morning.

Clustered within the missile's second stage are four vernier rockets. These rockets—their spherical cases fabricated from Republic Precipitation Hardenable Stainless Steel—play a vital part in Titan's jet steering system.



TITAN ON TARGET

...from preceding page

From liftoff to final power cutoff, Titan's solid fueled vernier rockets stabilize and position the missile for precise trajectory. Rockets operate in conjunction with an all-inertial guidance system.

Rocket cases are produced from Republic 17-7 PH Stainless Steel by the Martin Company, the Aerospace Division of Martin Marietta, builder of Titan II airframes.

Here, $\frac{1}{2}$ " thick flat circles are tapered by precision machining, then shaped by Martin's Marforming process (metal die plus flexible rubber female die). Rocket case "halves" are joined by heliarc welding.

With its high alloy content, 17-7 PH Stainless Steel is widely used in applications requiring greatest possible strength and corrosion resistance. The material is readily cold formed in the solution annealed condition. Hardening produces ultimate tensile strengths to 240,000 psi.

Republic also offers 17-4 PH[®] which requires only a one-hour heat treatment to develop ultimate tensile strength of over 200,000 psi; PH 15-7 Mo[®] with excellent mechanical properties to 800°F; and Republic A-286 which provides high notch toughness at temperatures to 1200°F.

Our metallurgists will help you select and apply the stainless steel, titanium metal, carbon or alloy steel best suited to your requirements. Contact your nearest Republic sales office for information. Mail the coupon at right for literature.



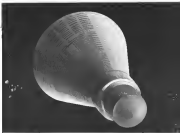
REPUBLIC STEEL

Cleveland 1, Ohio

*Patented under Pat. Nos. 2,970,000, 3,043,555 and Trade Mark of Corus



Republic 304S27 Stainless Steel is used extensively in the Lockheed F-104 for odd strength, low weight, resist heat and corrosion.



Republic is also a supplier of titanium in Project Mercury. The titanium-Air347C1—was used in the vehicle's double wall airframe construction.

PRODUCTS FOR DESIGN ENGINEERS
—Republinter presents useful design data: Stainless Steel, Titanium, Inconel, and Aluminum. Also an Republic High Strength Steels, Titanium, Stainless Steels, and Wrought Alloy Steel Metals.



AN STANDARD SERIES
—32 pages booklet covers types, available forms and conditions, heat treatments, properties, and fabricating methods. Send for your free copy today.

REPUBLIC STEEL CORPORATION

2491, 2492, 2493

1441 REPUBLIC BUILDING • CLEVELAND 1, OHIO

Please send the following booklet:

☐ Products for Design Engineers—AISI 316

☐ PH Stainless Steels—AISI 302

Name _____ Title _____

Company _____

Address _____

City _____ State _____

Strong, Modern, Dependable



U.S. Would Block Soviet Airlift to Cuba

Long-haul Moscow-Consuegra-Havana route is the only access; Russian aircraft trying it will be 'fured down.'

By L. L. Dobb

Washington—Any attempt by the Soviet Union to establish an airlift route between Russia and Cuba would be subject to the 4300-ft. airspace limit between Consuegra, Gaines, and Havana and would be subject to U.S. air interception.

A State Dept. spokesman last week told AVIATION WEEK that if the Soviets want an existing airlift route to Cuba, such plans will be "fured down," or being reaching their destination on the island. This could be an implication of Defense Secretary Robert S. McNamara's earlier statement that a procedure to cover airlift suspension had been worked out.

All Canadian airports were closed to the Soviets. Russia is not known to have bilateral agreements with any South American countries which are located south of its border, on trade routes between Africa and Cuba. The Soviet Union has refused to allow its airlines to fly to the Bahamas, which prevents airlift from flying the North Atlantic carrier route.

This leaves the Soviets with only the Consuegra-Havana route as an aerial access to Cuba. A State Dept. spokesman indicated that it is doubtful that any attempt would be made to establish a single lane on the long-haul route.

Shortly after announcement of the Cuban blockade, the Cuban government sealed off the island from all scheduled airline service by announcement of national warning pilots to stay clear of Cuban territorial waters.

Flow of passengers and mail from

the island suddenly came to a halt. Resumption of diplomatic communications still being studied in several governments as of late last week was extremely tentative. The Soviet Union, the last major link with Cuba, ran about Oct. 22 that all civilian flights from Cuba were planned until further notice and that any plane flying off without military permission would be shot down.

Pan Am has been operating two round trips daily between Miami and Havana. Flights into Havana normally arrive, leave, and then immediately return to Miami. The carrier has been held below its regular morning flight but departed, and that flight, along with all subsequent flights, were cancelled.

Other U.S. carriers involved in Soviet Havana-Brazil Airways, Delta Air Lines and National Airlines, doubt-

lessly their Havana service plans, recently, go. KLM Royal Dutch Airlines suspended its regular service between Miami and Havana and between Miami, Kingston, Antigua and Caracas upon receipt of the Cuban warning. Flights from Miami to Kingston and Antigua will be continued by chartering Cuban national airlines.

British Overseas Airways, which operates its fortnightly service between Miami and Havana, cancelled its scheduled flight Oct. 20 without explanation, but expects to resume the service in the future.

Barack Overseas Airways Corp. has scheduled an aircraft to begin Cuban territory on its route to Haiti, and General Eagle took similar steps with its Vietnam flights to Japan.

In other developments growing out of the Cuban case, the Federal Aviation Agency placed a moratorium on all civil aircraft flights in the southern two-thirds of the Florida peninsula. Under a special Civil Air Regulation issued yesterday by FAA Deputy Administrator William E. Smith, all aircraft operating in the area was ordered to file flight plans for military approval.

Yacult taking two-way radio communication and navigation equipment was prohibited. Registration of all aircrafts and current no-operation status.

Purpose of the curb on Florida flying is to protect aircraft and control air traffic movements in a critical defense area, but open to aircraft operators of commercial aircraft, according to the FAA.

Advisors in the command also will continue to move Havana, although such service has never been heavy. Scheduled flights of CSA Czechoslovak Airlines cut off any flight route between Prague and Havana via Moscow and Gander, Newfoundland. CSA will schedule separate service between Havana and Moscow, bypassing Gander, although the Canadian base specifically applies to Soviet Union aircraft en route to Cuba.

Cuba Airlines, which has been operating on a limited basis under the Castro regime, also was threatened to be cut out of its routes north service, between Havana and Prague. On Oct. 24, a Cuban Airlines flight from Prague to Havana, stopped at Gander, N.S., Labrador, but refueling because Gander was threatened. An Air Canada jet, also supposed to be checked by customs officials and a member of the Royal Canadian Mounted Police, but there is no sign that this is affecting flights to Canadian

FAA Distributes Airport Disaster Plan

Washington—New disaster control guide is being used by U.S. airport operators in the Federal Aviation Agency. Distribution of the 15-page pamphlet, which describes what should be done in the event of modern attack, probably is not related to the Cuban case.

The general location of airports near cities and possible target areas and existing means of damage (which might result from a nuclear attack) after close to the approach management might take in several planning, the guide states. It does not appear to link an airport with a possible Soviet target area in the U.S.

Airport operators who anticipate that radioactive fallout will present the most danger following a nuclear attack, according to the guide. Suggested survival measures include construction of shelters and suspension of access to increase the intensity of radiation.

CAA also recommends that each airport operator appoint a disaster control officer who should "establish contact" with local and state civil defense authorities and military units to link the airport program with the effects of these organizations.

Employing immediate steps, including evacuation, the guide suggests that the disaster control officer develop procedures for all emergency actions, establish a disaster control center, train disaster control team and work out control and agreements with local organizations.

Disaster management operations following a nuclear attack would be under a military official. If such efforts are successful, "your airport could serve as the link for survival of your community," the guide lists several options. It also states that a radio or phone link for receiving alert messages is as essential for every airport and tells out how these messages would be handled over various communication systems.

The guide was prepared in response to President Kennedy's February 1962 executive order, which gave to FAA responsibility for ensuring the country's ability to survive the nation's civil support. The guide was first issued by World Chaudhury Field, which serves the Washington, D.C. area. It is available through FAA's Airport Service.

ports would be handled during the crisis. For some time, the FAA has been making a study to the Western Hemisphere with Cuba as an ultimate destination (AW Sept. 23, p. 30). But now it is a flight route into the U.S. and South American countries, controlled by the Scandinavian line on transit rights has forced the Soviets to operate out of the Consuegra-Havana route.

Such was flight a Te-114 helicopter transport, which has been scheduled out of the route according to the State Dept. The Russians contributed substantial funds toward modernizing the Consuegra airport so it would serve as a jumping off point to the Western Hemisphere on the way from Moscow via Belgrade and Rangoon to the West.

Plans to settle a bilateral agreement between the U.S. and Russia negotiations dated last summer in the U.S., although Russia was known to have had a strong desire to launch the service (AW Aug. 6, p. 18). U.S. did not see the proposed route as a neutral economic exchange of traffic rights.

Issues at stake were considerable political and the State Dept. did not want to enter into an agreement that suggested recognition of long in the cold war. Russia's interest in the U.S. The Russians expressed disappointment over the decision.

It was the strategic goal of the Russians to get the Moscow-New York route and then seek to establish a direct route to Cuba. That having failed, the Russians turned to South America

countries and made preliminary advances for bilateral agreements covering shipping and transit rights, but apparently with little progress (AW Sept. 24, p. 32).

The Russians reportedly had planned to the long-range Te-114 helicopter to cover the South Atlantic route, but this flight would actually have been as part of an Aeroflot service in an large number. Flying flights that would be Aeroflot units, but have been scheduled with the smaller Il-18 helicopter transport (AW Sept. 10, p. 77).

The Te-114 pairing flight between Moscow and Havana—16,000 ft. trip—was completed in about 21 hr. flight time. The run from Moscow to Consuegra was completed in 18 hr. Presumably, the flight was operated with a light payload, in operational and some irregularities toward the Castro regime. CSA, however, approach procedure this has does not apply to it.

At all times last week, CSA had not surrendered in scheduled service between Prague and Havana. CSA has its quarters in Prague until last week it has no plans to change its service and was prepared to operate the regular Prague-Havana flight on schedule.

CSA operates the weekly Soviet-British independent transport—former Czech Airlines equipment equipped with CSA markings. The carrier has Break Air Markets, approved to fly into Frankfurt or Amsterdam after refueling but actually stops through New York, New York to Cuba. That having failed, the Russians turned to South America

when Consuegra was having maintenance difficulties previously, in the interest of security. The team was recently recalled and only one Break Air Markets equipment scheduled to operate between Consuegra and Havana, as a reconnaissance mission to Cuba, as a reconnaissance mission to Cuba Airlines.

However, the transport operators at Consuegra and CSA lack of operating experience on the route to Havana by Aeroflot and transit restrictions, it does not appear possible that the Russians will be able to get an airlift sufficient to move any supply line for weapons or troops. If this should be attempted, however, President Kennedy has stated that he was prepared, "if necessary," extend its shipping blockade to other "types of cargo and aircraft."

Meanwhile, various carrier flights from Miami and other Gulf Coast to South America have been severely affected by the new Cuban policy. On the other hand, flights were not cut in U.S. or traffic control authorities, this traffic was being handled around the island, which was being handled, and some flights were being handled around the island from Miami.

Before the cut in the civil aircraft flights from the Caribbean. To avoid being out of Cuba, airlines are now being closed southeast to the island from South Coast Island in the Bahamas, then southeast to Fort-Louis in Haiti.

The long haul South Coast to Fort-Louis, however, about 130 miles, is out of Cuba's control. But that navigation and air obstacles, near checkpoints were, the route from the point it leaves the Florida coast, and there is a high level of air traffic would still remain if no one attempt with land-based facilities.

In its Oct. 25 Notice to Airmen (Notam), the Havana air route traffic control center closed all flights to Cuba, over Cuba or its territorial waters. No flag airline was accepted, but even those owned by South American governments which, in the past, were expected to operate irregularly toward the Castro regime. CSA, however, approach procedure this has does not apply to it.

The Cuban government left itself a loophole to permit continuation of limited air service in the future. It said that flights "not authorized and approved by the military" could enter Cuba without further notice.

Latin American Airlines of Pan American, which operates a Douglas DC-7 on the route, asked what civil flights the Cuban military would approve. It was said by Havana customs that Pan American's service was not among those.

Even before it issued the special CAA warning flights in southern Florida, FAA had directed all U.S. civil aircraft



KEY WEST AIRPORT traffic controller works to cope with struggling to handle increased traffic in the South Florida area. Construction of new tower is going on immediately.

agencies to comply with the Cuban Notes.

Under international agreements, Cuba has the responsibility for controlling air traffic within a broad area called the Havana Flight Information Region (FIR). It is in this region, we met the dispute about Cuba, which U.S. airlines will try to avoid.

Although the parties desire around Cuba continue to insist on the status, the various facts that affect the Havana FIR may pose some problems. Its course has almost entirely over water and there are few radio navigation aids on route.

Moreover, the various airlines had usually within 15 days of Cuba's writers file. Cuba's westbound presence of Plaza del Rio contains the base of San Juan, where U.S. intelligence has reported large concentrations of MIG fighters. Airline pilots in route to Central American republics have reported encounters in which MIGs flew their wings for many miles before turning back to Cuba.

However, there was no sign last week that the Cuban situation was seriously curtailing the flow of commercial air traffic through the Caribbean. At Miami International Airport, officials said that no airlines had made changes in service despite the fact that the terminal was being used as a refueling stop for military flights. Miami, they added, had some surplus capacity and could accommodate additional flights if it proved necessary.

At Transport Asia said the Defense Dept. had made requests for information on the "availability of certain aircraft under certain conditions," but ATCA had not obtained what this meant. It is almost certain, however, that the Civil Reserve Air Fleet (CRAF) will not be activated unless the crisis goes beyond the Caribbean.

Under the CRAF program, U.S. airlines make more than 300 language transports available to Defense Dept. during times of utmost national emergency. But activation of CRAF would have a disruptive effect on domestic airline schedules, and therefore is considered a last ditch measure.

It seems safe to predict that Defense Dept., Military Air Transport Service, the single provider for all the armed services, can and probably will acquire it through one of two other methods. First, MATS can increase the so-called "express capability" closest to the conflict in that several commercial carriers. There are many who are part of the airlines that specific aircraft, listed by tail number, can be pressed into service by the military.

Second way, MATS can broaden its aircraft base to a number of "tail contracts" to various with surplus in capacity. These can be accepted or rejected by the airlines.

Airline Executives To Probe Idlewild Noise

New York, Conn., that will include top airline officials will be up-packed into by Louis J. Laffanti, state attorney general, to discuss noise noise around New York International Airport.

Following a public hearing last week, Laffanti said he wants further discussion to be the committee as the main problem before deciding whether he should seek legal action to correct the repeated nuisance to communities.

"And I want the surface" top team on that committee, not just administrators," Laffanti said. "Core group, the Federal Aviation Agency and Port of New York Authority will also be represented, he added."

Anton J. Tobin, executive director of the Port Authority, said Laffanti at last week's hearing that sufficient legal precedent already exist for handling noise complaints in the courts.

Mikolaj A. Muchnicki, president of Eastern Air Lines, environmental search for a solution outside legal channels, saying he was backed in this approach by Charles C. Tulligman, Jr., president of Trans World Airlines, and C. R. Smith, president of American Airlines. Harold E. Gray, executive vice president of Pan American World Airways, also appeared in support of Muchnicki's proposal.

Laffanti explained that there is no intention of curtailing air service at New York, but said he is not going to allow his search for an acceptable rule now be left parties involved in the same dispute.

No Agreement Seen On IATA Cargo Rates

Fixed annual on cargo rates still appeared highly unlikely last week at the International Air Transport Association (IATA) conference in Cleveland. After a lengthy argument on passenger fares in the North Atlantic and Latin American areas seemed almost done.

Passenger fare levels on the Pacific and Middle East areas were still in dispute in the conference's second day last week. Most delegates believed a vote on cargo rates is inevitable because of a statement on both specific commodity and weight-based rates.

Denunciation of Pan American and SAS to win authorization to charge pan airline taxes, and matching Lockheed and Middle East rates were also on the agenda. A 30% increase in the rate to a final decision on North Atlantic fares.

Compromise was reached on the com-

mercial "subsidies" mechanism, which would permit their carriers to declare an open rate situation at any corner suspected of violating tariff regulations failed to put a stop to these subsidies within 15 days. Several airlines protested the resolution on grounds that on its South American route, the limited number of carriers would make it difficult to monitor the support of most most airlines to maintain a third airline.

The conference voted to grant an exception to itself to permit it rate the passage of the resolution. A unanimous vote is required for approval of all items, first and second.

At France reportedly has been the major stumbling block to agreement on cargo rates because of its desire for a higher rate limit. None of some 100 specific commodity rates presented to the conference was approved, with Air France being the lone dissenter in a number of the proposals.

Generally, however, widespread differences on the majority of these rates have kept the cargo conference at a tight deadlock.

Safety Experts Study Successful Ditching

Washington—Civil Aeronautics Board investigators are taking a close look at how all 101 persons on board a chartered Northwest Airlines DC-7 were evacuated by crew members after the transport had been ditched in the ocean near Sitka, Alaska.

Proceedings continued during the week ending ended on a pattern for changes in the Civil Air Regulations which CAB may recommend to speed execution of aircraft involved in other nonfatal accidents. Airlines have saved dozens of lives, ditching their way out after other models in U.S. or better.

The DC-7, chartered by Military Air Transport Service, was carrying a number of women and children when a non-spare parachute failed it down in the flight from McChord AFB, Wash., to Eadsfield AFB, Alaska. After descending from 20,000 ft. through scattered clouds, Capt. Norman R. Hanson ditched in a calm sea near Sitka harbor. During the time the plane was aloft, almost 10 min., there on board were transferred to five T-28s on site.

Before the DC-7's crash, about 500 ft. of water, all of the passengers and crew had been packed up by a Federal Aviation Agency supply boat.

CAB last week was studying whether to revise the existing rules for bailing out of aircraft. It is considering a check to determine why the DC-7 could not remain airborne with three of four engines operating normally.



BOEING 320C JET FREIGHTER ordered by American Airlines has 55,000-lb. payload capacity with room for 17 cargo pallets. Two of the pallets were ordered for \$30 million. Aircraft, powered by Pratt & Whitney JT1D-1 turbojets of 10,000-lb. thrust, is now freighter.

American Buys 4 Boeing 320C Freighters

New York—More toward lower freight rates and increased airline capacity on daytime shipments are expected as result of American Airlines purchasing four Boeing 320C turboprop freighters.

Carrier will receive this first of the 320C's paid aircraft late next year, and the other three in 1964. Purchase price of \$30 million is being financed by available funds, without outside financing.

C. Murray Sadler, American general manager, said in announcing the purchase, that work that is now too early to determine whether the airline would lose some rates as result of the jet's greater capacity and lower operating costs.

However, he would consider going on any financial risk, saying of a jet operating to the shippers," Sadler said. "Any proposal to the Civil Aeronautics Board for a rate adjustment would come only after American Airlines has accurate data on the only of a jet freighter operation following a period of experience, he added."

To obtain maximum utilization of the jet, Sadler said American will seek to shift traditional cargo emphasis on night flights to a maximum of 1000 hours of daytime schedules.

Significant is American's purchase in that the aircraft are now freighter, and

one-entrance for passenger use at the 318C's ordered by Pan American World Airways. American's freighter have only two windows at the cockpit, their being its wing area observation. Sadler said the increasing growth of cargo volume generated American to buy the freighters.

"We're at the point where we had to make a decision," he said. "Finally, we have been pressed to keep up with the demand with our DC-7's."

American's freight volume is up 36% in the first nine months of this year. The airline anticipates it will be 15% million freight ton miles in 1963, compared with 115 million in 1961. Approximately 7% of American's revenue comes from freight.

American operates 14 DC-7's with each a 12,000-lb. payload capacity. Based on greater payload capability and utilization due to speed, the 320C's will more than double the life of American's present payload freighter fleet. Sadler said, the 320C's will operate at a direct operating cost of 5 cents per ton mile, and if something over 10 cents per ton mile when indirect operating costs are added. Direct operating cost alone on a DC-7P is 12 cents a ton mile, he said.

Daily utilization on the DC-7's averages 7 hr. per airplane day. American feels it will be somewhat higher on the

320C's, although Sadler did not predict the increase.

Jets will feature a refuel and track loading system developed by American. Moreover, it features its cooperation with American, Sadler said. "Passenger pallets can be placed in the cargo bay, across being through a 7 ft. 7 in. x 11 ft. 2 in. door forward of the wing. Pallets are positioned manually on the roller tracks. Sadler said less than 10% of the floor perimeter cost went into the AMF loading system.

Even with current ground equipment, a full freight load can be loaded and unloaded placed aboard in 1 hr., Sadler said. American is continuing its research into more efficient and faster ground-handling equipment, Sadler said.

Aircraft will be used for transcon tactical transport service, Sadler said, and perhaps on such short segments as Detroit-Chicago when demand permits such flights. The planes will concentrate on the major, long-haul markets, with American retaining some of its DC-7's to support aircraft for less-than-mainline points.

Sadler said that American will gradually sell its present freighters, and may buy some jets at the market opportu-

American's freighters, the backbone load factor on the 320C will be about 90% on transcontinental flights.



WIDE ACCESS DOOR of the Lockheed C-141 is evident on wood mockup (above). Loading platform, which extends with door opening, is adjustable to truckbed level, providing straight-in loading equipment. Wing block of the C-141 (below) is assembled in Lockheed's West Coast facility. It will be shipped in sections to the Minuteman III plant.



Versatility Key

By James R. Ashlock

Airbus—Convincing the air cargo field that the C-141 jet freighter will be an efficient for commercial operations as for military service is a major project of the Lockheed-Georgia Co. sales group. The L-300, civil version of the C-141, is often regarded as commercial cargo vessels is merely an adaptation of a military concept. Belief is also expressed that the L-300 has range and payload limits before those of all freighters which will be available well ahead of the L-300's projected 1986 availability date, and at costs comparable to the L-300's anticipated \$6,000,000 price tag.

"Criteria among military designers is cost/ton," says H. S. Hopkins, sales representative for the L-300. "The airlift may at first be encountered as an efficient, low-cost aircraft as for commercial operation."

Lockheed is promoting the L-300 as a versatile freighter suitable for operations in the regional to international range.

"We believe that by the time this airplane is ready, there will be a need for it that jet freighters now being sold can not meet," Hopkins said.

He maintains that Lockheed is aware of its definition of the C-141 cargo transporter and L-300 is a "design for flexible use."

Even though current production is toward the military version—undisputed since the C-141 is a government contract project—Lockheed has not ignored its commercial aspects, Hopkins told Area News Wire.

The L-300's ability to operate off 5,000-ft runways is often mentioned by cargo authorities who maintain loadings in the line to air freight success. But Lockheed is confident that a changing air cargo market will make this a preferred trait.

"It is reasonable to forecast that the cargo market will expand into areas that have no air freight service today," Hopkins says, citing the continued deconcentration of industry. "This will generate a shipping demand which the L-300 can serve from airports having only 5,000-6,000-ft runways."

Lockheed's performance charts show that even on a 1,000-ft run, the L-300 can lift its 116,000-lb maximum gross weight from a sea-level runway 7,500 ft long.

Because the C-141's military requirements call for a 70,000-lb design gross weight, the L-300 has generally been assumed to have the same. Ashlock, the L-300 often a 90,125-lb maximum payload maximum, although it can even

Point in L-300 Commercial Sales Effort

five weight can only 500 most. Payload/cargo capabilities chart shows that the L-300 is able to carry 85,750 lb for 1,500 miles at the maximum loaded 44,524 cruise speed. The L-300's maximum payload is 86,250 lb on 2,000-mi flight, and 94,250 lb on 1,000-mi segments.

Direct operating costs for the L-300, based on the 1968 Air Transport Association, indicate that it will fly for 4 cents a ton mile on segments between 1,000 and 1,500 mi. An absence of a single, defined line item in the direct operating costs, such as in characteristics with most other freighters, is an asset Lockheed emphasizes in its promotion. Even carrying the 90,125-lb maximum payload on a 700-mile flight could not cost over 5 cents a ton mile, Lockheed officials say.

Indirect Costs

In adding indirect operating costs to determine total cost of operation, Lockheed assumed that each L-300 unit would have at least three airports operating under one 1,000-1,500-mile route. Indirect costs include loading crew, ground administration, take and advertising, non-aircraft maintenance, landing fees, depreciation of special equipment, training and projecting expenses.

"Even with a minimum three-phase fleet," Lockheed officials point out, "an airline could today, at an average rate of 30 cents per ton that our block crew with a 90-ft load factor and a utilization of 50 ft per airplane day."

L-300 gross efficiency is not having to lift 7,600 lb of equipment installed on the C-141. Main item is the floor, which is 3,900 lb lighter in the L-300. The C-141 floor is heavier because of a military requirement that it sustain large, non-palletized loads such as vehicles and trailers. Strength for such items isn't mandatory necessary in the L-300.

Other weight cuts include flight station and avionics equipment, 1,500 lb; troop partitions, 1,500 lb; wingtip fences, 400 lb; and miscellaneous, 500 lb.

Removal of the military provisions provides an additional 220 cu ft of cargo space beneath the flight deck, including a special loading compartment for high-value items. Lockheed is also prepared to offer 130-cu ft package slots in each of the loading gear pods, some space devoted to such items as an auxiliary power unit and life rafts as the C-141.

C-141 will be flown by a four-person crew, with banks and seating for a second four-person relief crew. But the

L-300, following the current trend for commercial operations, is designed for a minimum cockpit crew of two.

L-300 is selected in the C-141 is main cargo compartment main. Section of its 31-ft length is level. The last 11 ft is on the adjustable loading platform, which tilts 11 deg, also retracted. Floor width is 113 in, with a walkway on either side. The usable height is 9 ft 1 in, approximately 2 ft higher than current freighters such as the C-141. The 90,125-lb maximum payload is based on a 16 ft per cu ft density.

"The capabilities of high cubic density on a small aircraft," Lockheed says, "and its good aspect of against those who feel the aircraft has too large a cargo area for practical commercial operation."

Hydraulically-operated air loading doors, called "petal doors" because at the time they are opened, they swing out from the fuselage, are not a need for exterior towers for line maintenance. A forward cargo door can be installed at the option of passengers. Forward is accomplished at ground level rather than through wing doors, an advantage in view of the L-300's high wing.

Although Lockheed has been working on broader later control, there is no plan to provide it in the petal door. Lockheed feels the L-300's loading gear is the most practical possible for all standpoints, especially its location for maintenance; since it is contained in pods on either side of the fuselage.

"The gear is fundamentally short, rugged, simple and has heavy backup

the loading and unloading operations.

Hopkins says that to maintain some business requirements, both the C-141 and L-300 are relatively conventional in design. The wings have about 75 deg of sweep, providing good shearfield and low-speed performance without a leading edge flap extension.

"The choice of wing geometry is probably one of the clearest examples of the Air Force's willingness to have the airlines optained for maximum operating costs rather than for more satisfactory high-speed requirements," Lockheed officials say.

Combination of 25-deg sweep with an average thickness ratio of 11.5% and an aspect ratio of 7.9 represents, in Lockheed's opinion, the best design for maximum operating economy.

Vertical Stabilizer

Vertical stabilizer contains a ladder for maintenance accessibility, allowing a need for exterior towers for line maintenance. A forward cargo door can be installed at the option of passengers. Forward is accomplished at ground level rather than through wing doors, an advantage in view of the L-300's high wing.

Although Lockheed has been working on broader later control, there is no plan to provide it in the petal door.

Lockheed feels the L-300's loading gear is the most practical possible for all standpoints, especially its location for maintenance; since it is contained in pods on either side of the fuselage.

"The gear is fundamentally short, rugged, simple and has heavy backup



WING TUNNEL MODEL of the C-141 illustrates design of the Lockheed jet freighter. Reverse of its location stop the tail, the horizontal stabilizer is smaller than would be required if it was located in the fuselage, resulting in a weight saving of over 2,000 lb. C-141 has a design payload of 70,000 lb.



ADVANCED SATURN, shown in artist's concept above, will be the two-world's largest rocket, standing over 300 feet high and carrying 55 feet in diameter. Total weight will be approximately 6,000,000 pounds. A Saturn I, for research and Space Administration program, Saturn will be used to put in orbit and space

ships, including the three-man Apollo vehicle's home flight. Saturn will be able to place 100 tons in earth orbit, or transport several tons of equipment to Mars. Boeing holds NASA contract to develop, build and test the S-II first stage booster, comprising half program developing thrust equal to about 360 million horsepower.

Capability has many faces at Boeing



AIR CARGO extends jet age with new 707-320 cargo jets. Already ordered by two airlines (Pan American and United Airways) 3202 are more than 40 feet in 315 mph, providing "more carrying" deliveries between cities or continents.



MISSILE LAUNCH U.S. Air Force jets also shown during B-52 launching a hydrogen missile. The nation's first air-launched hydrogen missile, now under development, Yonah 802, made launches into early and low-level targets, firing 100 miles, as well as high-level targets, striking it to strike a number of and very targets in a single stroke.



BOEING



B-44 is taking off from Bradley Field, Conn. Aircraft is using its turbojet for the Pratt & Whitney TF33P7 31,600-hp thrust turbojet engine which will sit in the wing(s) for the Lockheed C-141A Starliner. Engine, which is power source of the TF33P7, drives the TF33 which powers the B-44, is mounted under the right wing. Left engine powering the aircraft is the TF33P7 turbojet rated at 16,000 hp. (Inset: The TF33P7 is being manufactured P&W's East Hartford, Conn. plant.)

structure is an ideal place for ground loadings," spokesmen say.

One handling being the L-180 is its weight in relation to the runway strength of airport from which it is designed to operate.

Lockheed is competing with Federal Aviation Agency as an airport owner in a study of the problem (AW Oct. 22, p. 17).

Pratt & Whitney JT3D-5A turbojet engines of the L-180 will each produce 25,000 lb. of thrust. Lockheed feels these engines, more powerful than those on any commercial jet now flying, give the aircraft a safety factor of special significance.

Thrusting was Lockheed is naming the high power advantage given with the turbojet C-130 Hercules through to the C-140. The C-140 is also expected to run engines during long-distance flights by the Coast Guard, he said.

L-180's performance chart shows it capable of climbing 1,000 ft. at 20,000 ft. with a 550,000 lb. gross weight, and 2,000 ft. at 6,000 ft. Area on two engines at 6,000 ft. per minute climb to 20,000 ft. with a 260,000 lb. gross. All climb rates are based on minimum continuous thrust and standard temperatures.

Military version of the JT3D-5A, designated the TF33P7 and ranked for use on the C-141, is undergoing in-flight evaluation on a B-56 testbed version.

E. A. Cleveland, assistant chief engi-

neer for C-141 development, says Lockheed received wide reaction in the design criteria obtained from individual commercial carriers on their ideas of an ideal freighter.

Maximum payload capacity ranged from 20,000 to 200,000 lb. for range of 1,000 to 4,000 nautical miles.

British SST Tests

London-Bristol Aircraft Establishment has made several tests on cooling and conditioning systems for supersonic aircraft, with emphasis on supersonic transport passenger cabins.

Cooling laboratory has been built at RAE, Farnborough, to test systems for a Mach 2.2 supersonic transport and the YSR-2 supersonic cruise and reconnaissance fighters. Latter was in earlier construction, and the supersonic transport project is still being negotiated between British and French governments (AW Sept. 17, p. 14).

Farnborough laboratory has built a passenger cabin section 22 ft. in diameter and 20 ft. long mounted on an altitude chamber. Test temperatures up to 300°F will be simulated by 1,400 oil-filled heating elements mounted around the cabin. Cabin is fitted with 24 seats which will hold reinforced aluminum structure in only test dummies, and known as a test dummy. At 200°F, test temperatures are constant at about 600° Fahrenheit, two can complete flights up to Mach 5 at 80,000 ft.

speeds from 710 to 600 ft. cruise consumption volume from 1,000 to 14,500 cu ft. and maximum gross weight take off field length from 4,500 to 10,000 ft.

"It is not surprising that any single carrier can truthfully state that this airplane does not fit its requirements in every detail," Cleveland says.

"It does appear from our preliminary studies, however, that the turbojet-powered range, speed, cargo capacity, size and airport performance of the aircraft are in optimum on some of the three major requirements as any single airplane can be," he adds.

Public Vote Approves New Basle Proposal

Basle-Basel Airport Establishment project's present facilities was approved last week by a 2:1 majority in a public ballot.

Basle-Basel Airport Establishment project's present facilities was approved last week by a 2:1 majority in a public ballot.

Original proposal (AW Jan. 8, p. 45), which called for about 515 ft. runway for a five-floor terminal, larger runways and additional technical facilities, was defeated by a bare majority in a public vote in June, 1965.

Today all units of a Navy task force can rely on a common distress alarm simultaneously. The task force is synchronized by a high-speed information network called the Naval Tactical Data System (NTDS). The system is linked together by Collins data transmission and SSB radio equipment. NTDS gathers combat information from assets and darts throughout the task force. Data is transmitted to the extent of several days ahead computer centers. There it's processed into an up-to-the-minute tactical picture and relayed to the Task Force Commanders and all unit commanders. Collins also has developed its software version of NTDS and a number of special-purpose voice and data communication systems for ships and fleet aircraft. Collins Lotus C networking systems are providing information for navigation, cable laying and repair, AEW and other applications whose common purpose forms a vein. Collins marine system specialists may have already answered an important question you're living now. Why not get in touch immediately with that outstanding source for ideas, equipment and installation service? Call Collins Radio Company...ADress 5-2531 in Dallas, Texas.



Study Disputes Airlines on Deficit Issue

Washington—White House study of international air transport policy will take issue with the airline industry's claim that air transportation has been a burden in the U.S. international balance-of-payments deficit.

The White House steering committee, which will make final recommendations on an international air policy to the President on Dec. 1 (AW Sept. 15, p. 45) has not fully developed all details of its proposal. Late last week, the committee was still in heated discussion as to which factors of the study prepared by private consultants will be used in the final recommendations policy.

However, it now appears that the balance-of-payments issue as proposed in the basic study will be adopted in one of the recommendations which will go to the President. In essence, the study states that balance-of-payments poses no real problem in the evaluation of the relationship between foreign and U.S. flag carriers.

Last week, Stuart G. Tipton, president of the Air Transport Association, is quoted in an earlier statement that the balance-of-payments deficit gives urgency to the need for legislation to deal with foreign carrier destructive rate and capacity practices. He added:

"Air transportation is just as real a factor in our balance-of-payments position as two tangible commodities, and an international trip on a foreign flag airline often has a U.S. airline has a similar impact on our balance-of-payments as the purchase of an imported commodity. Be the same value, when a U.S. airline serves a market of a foreign country, this has a similar impact on our balance-of-payments as the export of a U.S. typewriter."

The White House study will argue that this reasoning, while correct, tells only a part of the story. It will state that balance-of-payments is an international factor like U.S. tourism.

Foreign flag carriers purchase the vast majority of their aircraft, a large number of engines, spares and parts here, providing a debit to the U.S.

Foreign flag aircraft serving the U.S. spend substantial sums here in advertising, fuel, repair and rental of sales offices, ticket offices and lounge space, adding to the dollar flow.

Tipton holds that the balance-of-payments deficit on air transportation is about \$100 million annually. He bases this on the fact that U.S. residents pay \$390 million in foreign flag tickets, while the U.S. international airlines receive only \$145 million from residents of other nations.

The White House study's relation to this debit-credit deficit will be to pro-

duce more foreign visitors to the U.S. In fact, a key recommendation of the study is that the industry should encourage the development of the international market and place less emphasis on the dwindling share of U.S. traffic in the present market (AW Sept. 10, p. 31).

The study will suggest that the volume of foreign traffic cannot be increased if foreign flag carriers are restricted in their services to the U.S. Such a move, the study will suggest, would discourage foreign tourists from flying to the U.S., and thus reduce the market available to U.S. airlines.

An earlier White House study on aviation goals, Project Horizon (AW Sept. 14, 1967, p. 30), confirmed closely to the airline industry's position on the balance-of-payments issue. Citing the need for continued U.S. presence on international air transportation, the study said:

"Our flag carriers should expand on a profitable basis, since our U.S. international air transportation system will play an important economic role in supporting our maintenance of security and related equipment, creating undeveloped markets, reducing the balance of dollar payments, and adding major other segments of the national economy."

Three years made last week to allow the airlines to use the full draft of the policy developed by the committee. The document reportedly came about as a direct result of airline pressure on the committee.

Last month Federal Aviation Agency Administrator N. E. Haley, chairman of the steering committee, will meet with the airlines to review the policy. However, the original 600-page study, which was prepared by Systems Analysis and Research Corp. and Robert R. Nathan Associates, will probably not be released.

First drafts was scheduled for circulation among the airlines last week. This week, the draft will be reviewed in a special session by U.S. CAB, State Dept., Commerce Dept., Defense Dept., Agency for International Development, White House staff and Bureau of the Budget.

Meanwhile, the airlines are not at all united as to what policy they want. The policy the industry has adopted in recent years is to limit and limit to encourage important markets to ensure short-term gains on a number of major routes.

The policy, our committee was sent for Latin America, for example, would continue the policy the airline carriers might want for its Pacific operations which, in

turn, could be at odds with the policy of another U.S. carrier in that area.

In a more specific instance, Pan American World Airways is vigorously opposed to a CAB staff proposal that North Atlantic carriers serve Europe on a seasonal basis. TWA, on the other hand, strongly supports that principle, which is a basic recommendation in the White House study. These differences make it difficult for the airlines to set a single policy uniformity to all carriers.

Aeroflot Passenger, Cargo Data Revealed

Moscow—Russia's Central Statistical Administration has for the first time included specific Soviet air transport data in its annual economic handbook.

"The USSR in Figures" contains the new information which is long U.S. load over Russia in air cargo as well as per passenger traffic.

In past years, the Soviet publication gave specific data for oil, coal, rice, grain and automobile transportation. But figures on Russian air transport were only provided in terms of percentage gain over an undisclosed 1940 base figure, which, for purposes of comparison, equal 1938.

The Russian handbook contains figures published by Russian newspapers earlier this year on the number of passengers moved by Aeroflot: 21.8 million in 1963, 26 million in 1964, 32.2 million in 1959, 32.2 million in 1958, and 400,000 in 1940.

The U.S. scheduled airline industry handled 55,414,800 passengers in 1963.

Other Aeroflot traffic information included:

- Passenger-kilometers (kiloms): 1961—16.5, 1962—17.1, 1973—17.1, 1953—16.5, 1940—9.7. U.S. scheduled airline industry: less than 60 billion passenger-kilometers in 1961.
- Mail (thousands of tons): 1962—79.6, 1963—80.7, 1973—81.9, 1953—78.8, 1940—34.3.
- Cargo (thousands of tons): 1961—547.1, 1962—545.5, 1973—544.4, 1953—557.8, 1940—41.1.
- Cargo (thousands of ton-kilometers, or ton-kiloms): 1961—801.8, 1962—802.8, 1973—835.6, 1953—819.4, 1940—132.7. U.S. scheduled airline industry: less than 1,799 million tons and mail ton-kilometers in 1961.
- "The USSR in Figures" continued to present Aeroflot's scheduled route mileage in percentages of the 1940 figure: 1961—214% (1962—205%, 1973—247%, 1955—141%, 1940—100%.

MOHAWK CHOOSES BAC ONE-ELEVEN



BAC

JET PROGRESS TO THE VORACITY WITH EVEN BETTER THAN VORACITY ECONOMY

ONE-ELEVEN

TWO ROLLS-ROYCE SPEY TURBOFAN ENGINES

THE SHORT HAUL JET
BRITISH AIRCRAFT CORPORATION

ONE HUNDRED PAUL MALL LONDON SW1 ENGLAND

Mr Robert E. Peach,
President of Mohawk Airlines Inc, says

"Mohawk Airlines is pleased to be the first regional carrier in the United States to purchase the BAC One-Eleven. After extensive studies we found it to be ideally suited to our routes, the first jet we get powered aircraft to be built infrequently from a capacity point of view for Mohawk's intended operations, yet economic to operate over relatively short distances. We are proud to have shared in some of the developmental thinking of this aircraft which will provide Mohawk's customers with the finest jet equipment available."



AIRLINE OBSERVER

■ **Question of the extent to which U.S. airlines should be regulated under the Federal Aviation Act of 1938 again has been raised by a Civil Aeronautics Board chairman.** Speaking at a recent Aviation Writers Assn. meeting (AWW Oct. 22, p. 34), CAB Chairman Alan B. Boyd said that if the industry is to be wholly regulated, then the number of carriers operating in its field is no significance. If, on the other hand, competition is to be stressed, then carriers may be in order. Previous Board members have found that the legal requirements for fostering competition within a regulated industry create a dilemma.

• Strong de Havilland sales team, including John Cunningham, chief test pilot and company director, was in Australia last week to push its Trident three-jet transport in competition with the Boeing 727. Potential customers are Amers-ANA and Trans-Australia Airlines. Major sales points are ability to deliver on time, and an extensive after-sales service organisation.

■ Japanese Ministry of Transport has issued a White Paper on civil aviation recommending that the government give more assistance to Japan Air Lines to improve its competitive strength in international operations. It also called for a loosening of regulations for domestic airline route licensing.

► Eastern Air Lines has graduated 450 certificated flight engineers since the program began last July (AW July 30, p. 29). That is 700 engineers, 100 more than the airline had when the flight engineers' strike began. At the present time, about 200 pilots are taking the 150-hr flight engineer course.

■ W. A. Patterson, president of United Air Lines, says he is convinced fast-food restaurants attract the airline market. In a speech last week, he stated that "Thursday may look impressive in airline advertising, but it makes no sense at all."

■ U.S. Travel Service reports a 90% increase in the number of French travelers visiting the U.S. during the first eight months of the year. Number of U.S. visits issued French travelers increased from 12,140 in the 1961 eight-month period to 18,786 in the same period this year.

► Russia claims its single-engine An-2 biplanes are now arriving 1,105 mi. at An Malyi across the Altaiian Republic of Mongolia. It says that the corridor links together a total of 28 cities and towns. The Russians have trained Malyi citizens to be merchants abroad the An-2s, which are flown by Soviet pilots. Besides An-2s, An Malyi has Soviet-supplied, four-engine prop 3-16 twin-engine 3-14s and helicopters.

✶ Eastern Air Lines has blamed the industry's failure to adopt its new proposed tariff (AWOT 15, p. 42) as the reason for withdrawing unique portions of the fare revision from the CAB. Provision for a 20% reduction on round-trip tickets during certain days of the week and proposal for a 41% increase in jet day and night coach fares have been dropped. Request to reduce fares on the Air Shuttle will stand unchanged, the airline said.

■ New York, *Aerostar Vernal 107s* are operating with transmission shafts strengthened by shot peening, and these in turn will be replaced by new shafts that are designed for enhanced life. Efforts by the Federal Aviation Agency Vernal also is working on a technique to reduce rotor flap noise in the aircraft, which Vernal believes is produced primarily by the rotor blade tip where the front and rear rotor disk zone overlap. Retainer retrofits are planned to suppress this noise, but New York Aircraft cannot spare any of its three in service for this modification now.

• FAA has received a survey that measures the noise generated by 28 currently used turboprop transports, turboprop air freighters and turbine helicopters on takeoff and landing. It will use this data, which was compiled by an acoustic consulting firm called Polytechnic, to update Planning Series No. 3. This document was issued to the Federal Housing Administration in 1960 to guide it in granting mortgage loans on property near airports. The new survey measures both the intensity of aircraft noise in decibels and its frequency distribution in cycles per second, and could serve as the basis for an FAA regulation prescribing maximum noise levels around U.S. airports.

SHORTLINES

• **American Airlines** will begin service at Dallas International Airport Dec. 1 with three jet flights daily, two one-stop round trips between Washington and Los Angeles and one round trip from Washington to Dallas and San Francisco.

► International Air Transport Assn.'s sixth public relations conference will be held in Washington Nov. 12-15. Total of 70 delegates and observers are scheduled to attend.

✶ **Lake Central Airlines** has filed a suit with the Civil Aeronautics Board which would permit foreign visitors to the U.S. to have unlimited air travel on the carrier's system during a 30-day period for \$75. For children of such travelers, the price would be \$37.50, under the tariff, provided they are under 21.

► National Airlines has week inaugurated nonstop jet flights from New York to Jacksonville and Tampa-St. Petersburg. One nonstop daily flight will be operated to each of the Florida areas.

■ Northwest Airlines will operate 70 jet flights weekly between Chicago and Miami beginning Dec. 15. It will also increase its five flights a week between New York and Chicago and Miami to one daily.

►Salvina Belgian World Airlines has a record 4,379 transatlantic passengers onboard in September, a 37% increase over the volume handled in the same month last year. The carrier flew 5,670 passengers westbound in the same month, a 17% increase.

► **Seaboard World Airlines** has reported a net profit of \$362,000 for the month of August on revenues totaling \$2.6 million. For the first eight months of 1982, the airline showed a \$62,880 net loss.

■ **TABSO**, Bulgaria's state-owned airline reported its route network totaled 3,513 km, on the airline's recent 12th anniversary, included are 840 km of domestic and 2,693 km. of international routes.

► Trans World Airlines has unveiled its applications to the Transportation Dept. to reveal cuts to include Lebanon as an additional area to be served by the airline if the CAB adopts a policy of regional competition for U.S. international carriers.



^a The Stress and Diffusion are almost equally sized indicators in these World studies. In

Meet the team that saves you time

You fly to save time. Getting you there on time is a team operation at TWA. Skilled, seasoned flight and ground crews make on-time-ness a habit—in 70 U.S. cities and 15 overseas centers. Only TWA flies the StarStream[®] breed of the transcontinental jets. Four mighty DynaFam[®] engines give the StarStream quicker take-off, softer climb rate than any other coast-to-coast jet. The StarStream cruises at more than ten miles a minute, and has the tremendous power reserve to trill to maintaining precise flight schedules. On the ground, TWA saves you time with innovations like split-second electronic flight information, speeded-up check-in facilities, unique "carrousel" baggage delivery. Compare what all airlines offer. Compare... and you'll fly TWA.

Nationwide
Worship
discuss on





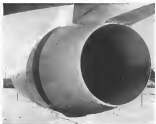
Convair 990A turboprop (transport) has new wing fillet (arrow), nacelle extensions, wing rooter change and full-span Krueger flaps to improve speed and short field characteristics. Changes now under review agreement reached with Swissair and American Airlines to bring the 990 up to required performance parameters (AW Sept. 16, 1963, p. 48; Sept. 23, 1963, p. 51A; Oct. 6, 1963, pp. 43-46).

Convair 990A Has Wing, Flap, Nacelle Changes

Full length Krueger flaps against the former installation of Krueger flaps and leading edge slots. Wing leading edge has been modified so that it has less camber. Cambered-inboard section shows how camber change designed for the Stratus and has been criticized by FAA. Another version, for American but basically the same, will begin certification testing in November (AW Oct. 21, p. 56).



Engine pods have been extended outward 21 in. to eliminate drag which prevented original 990 from meeting performance parameters. Engine nacelles have been added to the 990A engine pods and terminal nacelles on the inboard side of each engine pod nacelle, left of which are photographs of nacelle design proposals. Two photos above, below left show nacelle opening with throat pressure close deck inside. Nacelle, below right is in normal flight position. Convair has flown 990A about 125 hr.



HOW MUCH

DIGITAL COUNTER SHOULD YOU BUY?



CMC unit with 15 Mhz internal clock (Date 04/82, 1990)

Only as much as you need!

You can't get stuck with more counter than you need when you buy from CMC. Because CMC offers a wide choice of models with numerous standard options, you get a counter suited to your particular requirement. You don't pay extra for an instrument loaded with costly features which may be unnecessary (such as multiple ported memory, high crystal stability, laser readout and remote programming, etc).

CMC offers solid state standard counters from 10 to 1000 Mc with

either vertical or inline slots needed for low and high frequency models with. Do not an analog input with a frequency input impedance is standard in most models. Calibration, maintenance and trouble-shooting operations are fast and simple with CMC counters because all PC boards are plug-in design. A minimum of five several calibration adjustments makes CMC counters by far the easiest to operate in this regard. The readout is unique with the DDU and does not require trouble-shooting only a matter of a simple one-operation DDU replacement.

* These Features are ALL Optional on CMC Counters.

- | | | |
|---|---|---|
| <input type="checkbox"/> Extended Range to 75 Mc (option F—\$180) | <input type="checkbox"/> Inline Readout (option K)—\$75 per decade | <input type="checkbox"/> Memory option L—\$25 per decade |
| <input type="checkbox"/> 50-400 cps operation (option G—\$75) | <input type="checkbox"/> Multiple Panel (option M) | <input type="checkbox"/> Rack Mount (option O)—no charge |
| <input type="checkbox"/> Additional Readout Decade (option Y—\$180) | <input type="checkbox"/> Rear Input Connectors (option T—\$20) | <input type="checkbox"/> Remote Program (option R—\$250—\$30 for high frequency models) |
| <input type="checkbox"/> 1 part in 10 ⁶ per dec crystal stability (option N—\$125) | <input type="checkbox"/> External Time Base, rear input (option W—\$20) | |

TYPICAL CMC SOLID STATE COUNTERS

Range	Frequency	Price	Model	Range	Frequency	Price	Model
1 cps — 1 Mc	F	\$ 175	1000	10 cps — 10 Mc	W	\$1 100	1000
1.001 — 1.002	F-P	1 400	1000	1.001 — 10.001	W	1 400	1000
10 — 1000	F-P	1 500	1000	10 — 1000 Mc	F	1 700	1000
10 — 1000	F-P	1 600	1000	10 — 1000 Mc	F	1 700	1000
10 — 1000	F-P	1 600	1000	10 — 1000 Mc	F	1 700	1000
10 — 1000	F-P	1 600	1000	10 — 1000 Mc	F	1 700	1000
10 — 1000	F-P	1 600	1000	10 — 1000 Mc	F	1 700	1000
10 — 1000	F-P	1 600	1000	10 — 1000 Mc	F	1 700	1000

F = Frequency
P = Frequency Port
W = Time Interval Measurement
M = Universal Count-In-Time

CMC

COMPUTER MEASUREMENTS COMPANY

A Division of Pacific Industries Inc.

12500 Brindley Ave. • San Fernando, Calif. • Phone: (818) 867-2381 • TWX: 233-764-5995



412L Search Radar Delivered to USAF

Four AN/TPS-22 Search Radar units for use with 412L weapon control systems have been delivered by Westinghouse Defense Controls Electronics Division to Seymour Johnson AFB, N. C. Radar units are air-transported "pre-assembled and tested" systems. This permits it to be disassembled and transported in five trucks of size shown. Radar can be set up and put into operation within six hours. Westinghouse says.

achievement of the other participating product divisions. But to the Air Force the Minuteman Division is the active supplier and supplier for Autometrics on the program according to C. F. Ballard, chief engineer.

The division works with the Air Force to establish new all system spin-offs, then to turn projects specific new for all major subdivisions, such as the radar division work. The Minuteman Division also supports the over all plan of action, prepares proposals, handles contract change, services exhibits and opposes schedules and budgets.

Early in the program, the Minuteman Division purchased all high-achievable components, inspected and assembled them in printed circuit boards which are then sent to the product division for evaluation in their equipment. This was done by a single controlled source for all components and events. Once the required standards had been established, the functions were turned over to the Computer and Data Systems Division, which now performs the same function for both civil and the International Airborne Division on the Minuteman program.

Meanwhile, the Minuteman Division conducts its own engineering as its main task, even that operations are being set in the Airborne plant at the Airborne and Pacific Missile Ranges and at the missile sites.

elsewhere in North America. For instance, Ballistic missile from X-45 Space and Information Systems Division while Aerospace came from corporate headquarters.

The division's responsibilities also include some of long-range, detail which normally would not be assigned to a management division but which Autometrics President John R. Moore strongly feels must reside there if adequate control is to be exercised.

For example, the Minuteman Division is responsible for making lists of approved components which the product division engineers are allowed to use.

It standardizes the dimensions of printed circuit boards used in all sub-systems, establishes parts application standards to assure that the same drawings are used by all designers working on the project.

In the near future, even more rigorous controls will be introduced according to Ballard. For example, the product division engineers, design teams will be prohibited even from ordering unapproved parts without specific authorization from the Minuteman Division. Also drawings can not be released for production without its approval.

Ballard stresses that this set of authority does not breed popularity, but he says that these standards are accepted by the operating divisions as necessary for efficient overall program objectives.

The division also does a small amount of electronic design of special electronic instrumentation required for flight tests or special checkout equipment needed for engineering tests. But the manufacture of such equipment is



TV Camera Used in Towed Target Tests

Cloud-trail television camera has been mounted on a Glavin-Matrix TT22 jet to simulate performance of Del Mar towed target system during evaluation tests made by the Royal Aircraft Establishment, Boreham Down, England. Camera unit, manufactured by EMI Electronics, Ltd., is mounted off the cockpit canopy and is powered by 12-v battery. Receiver is mounted in nose of the aircraft, who also operates the target vehicle.

Our learning curve is 13,000 trans ports long...

**and the result of that
experience is visible in
the great new DC-8F**



Douglas transports have been the finest of their time for military air logistics and commercial transportation for 30 years. Here are a few reasons why:

Ruggedness—DC-3s and C-47s more than 25 years old are still flying regular schedules. DC-3s are proving airlines with utilization rates as high as 12 hours a day. The productivity of Douglas military and commercial transports has been unmatched.

High performance—DC-3s, DC-6s and DC-7s were the fastest transports of their time. C-124s and C-130s are both weight-lifting champions. The DC-8 has flown higher, farther and faster (actually exceeding the speed of sound) than any other jetliner.

Versatility—Within the capability of C-124s supplying "Dow Line" stations and making one-lift drops at the South Pole... the C-133 trans-

porting ICBMs while and carrying freight in bigger chunks than any other aircraft... the magnificent performance of C-47s flying "the hump" during World War II... the warhorse dependability of C-54s and C-119s during the Berlin airlift. And take note that the new DC-8F "Jet Trader" can be converted to any of 12 configurations in less than 2 hours.

Every Douglas transport is designed and built to endure conditions far beyond any it is ever expected to meet. That's why a large proportion of the 12,000 Douglas transports which have been flying through all emergencies for years past will still be flying for many years... and you can expect even greater things from future Douglas transports.

DOUGLAS BUILDS GREAT TRANSPORTS





**Pick the
amplification
you want—
for this flexible
DC-5KC**

**Sanborn optical
oscilloscope**

INPUT SIGNALS SIMPLE... OR SOPHISTICATED?

Now you can "choose-in" ten 6- to 24-channel full frequency "ASO Scope" Sanborn recording system to your individual recording requirements — with a choice of four different 6- or 8-channel amplifier modules. Each unit has complete circuitry from input signal to optical galvanometer output controls, individual channel amplifiers and galvanometer matching networks on plug-in cards, and a common power supply for all channels. One two or three amplifier modules, each occupying only 7" of panel space, may be combined with the 650-100 Recorder to provide 6 to 24 channels of direct record recording onto 8" amplifiers. System response — with a single set of galvanometers — at DC to 3 KC over full scale, DC to 5 KC over 4" amplifiers.

System uses any of the four "ASO Scope" amplifiers having linearity 1/1% of full scale, selected frequency response characteristics, low noise and drift, and high gain stability. The amplifiers differ mainly in sensitivity, noise characteristics, additional front panel controls and price. For high gain carrier amplification of standard outputs as low as 50 μ v rms, carrier 4.5 to 5 volts — 20 KC current excitation, the Model 650-100 amplifier provides maximum sensitivity. General purpose DC amplification is available with the 650-200 amplifier, which has a more recording sensitivity in the system of a 5 mV/inch and provides floating and guarded inputs. Models 650-2500 and 2000 provide maximum sensitivities of 500 mV/inch and 0.5 mV/inch, respectively.

For complete specifications and technical application help, call your nearest Sanborn Industrial Sales Engineering Representative, offices throughout the U.S., Canada and foreign countries. Ask him for a copy of the complete Industrial Catalog — covering oscillographic, X-Y response type and event recorders, data amplifiers, transmitters, related instruments.

INDUSTRIAL DIVISION

SANBORN COMPANY

WILMINGTON, DE. MASS.

A subsidiary of Norden-Ford Company

forwarded out to another division as contractor.

One of the important potential advantages of a digital computer over the analog type used for guidance in early ballistic missiles is flexibility—the ability to handle a variety of different problems. But little use has been made of this inherent flexibility in ICBMs prior to Minuteman, except for general rapid change of targets by changing stored computer program coordinates.

While the guidance computer plays a relatively important mission role, in previous ballistic missiles this role has been a hard one having only during two or three months of powered flight plus brief periods of operation on the ground when the computer was reprogramming the circuit.

Pre-launch Testing

To perform pre-launch testing of the missile's guidance and flight control systems, previous ICBMs have required separate ground-based equipment. This equipment, usually digital in operation, also had an important but brief role which ended when the missile was launched.

In the design of the Minuteman, the Air Force's Aerospace Division first used the idea of designing the missile's guidance computer so it could serve a dual function, being used also to test the overall guidance system prior to launch.

This same concept has been applied to the Minuteman, with several reported advantages. The cost and complexity of the also modification is greatly reduced. The missile-borne computer is continuously exercised, without diverting an operational test time. If a poor quality component has slipped through the rigorous reliability screen, it is far better that it produce a problem before launch procedures than during critical moments prior to missile launch.

To provide this added capability, to reduce the weight of the computer by less than 5 lb., at about 14% — but this greatly reduces the number of unit tests which otherwise would have to be brought out through the reliability screening in an overall weight saving in the missile. When the Atlas and Titan vehicles were launched, several hundred wires, the Minuteman can trace a total of only 40. AVIATION WEEK notes.

At every stage of checkout, the digital computer serves as the Minuteman's conversational wife. The couple would. During the missile ascent, it is used to check out each unit, including both of the mode control unit, flight control, staging devices, inertial components and other elements of the system. According to Dr. W. L. Moore, computer project engineer.

When the Minuteman is notified in the air, the computer takes over the



Position Display for General Aviation Aircraft

Position display for general aviation aircraft, called Flinsit 2, gives pilot continuous information of actual position with respect to selected altimeter chart. New display with its 52.25 in. diameter 8 x 7 x 24 in., including master instrumented system package measuring 8 x 4 x 4 in. Power consumption is 15 watts at 28 vdc, or 3 amps at 16 vdc. Display shows depth from aircraft's own range (VOR) and distance measuring (DME) receivers. Manufacturers: ACF Electronics Division, ACF Industries, Panama, N.E.

machine testing and calibration. Finally, at launch time it performs the count down test and initiates the flight program. After launch the computer switches modes and carries out stage two recheckouts.

Computer Functions

While previous ICBMs have required a separate signal conditioner to convert guidance computer signals into a form suitable for operating the flight control system, this function also is built into the Minuteman computer, making it a highly flexible device.

The computer determines when staging should occur, counts off air commands, and finally determines when the third stage should be cut free to the warhead to hit the extended target, according to Moore.

The missile computer performs two types of mission checks. One, which it conducts continuously while the missile is on its normal alert status (ready

for launch within 60 sec.) is a qualitative check to insure that all subsystems are functioning.

Periodically, a more rigorous quantitative check is conducted by the computer which includes measurements to determine how well each element is operating and whether there has been any degradation in performance.

For example, when the routine check-out check introduces a signal into the flight control amplifier to determine that each missile actuator moves in the proper direction, the periodic quantitative test measures the response time of the actuator as well.

During this checkout, the computer also intensively recalibrates elements such as gyro or accelerometers which might have drifted slightly since the last check. The results of all measurements are printed out for subsequent analysis.

Because the computer of the Minuteman performs the checkout, it is necessary to provide some external means to



Why so many computer users prefer the Control Data 1604/1604-A

...and five reasons why it will pay you to know!

The Control Data 1604/1604-A Computer, demonstrated a leader in a competitive and demanding field, continues to prove its ability to scientists and engineers as the computer to solve their problems, and to management as the computer to help maintain their profit. Here are the reasons why!

RELIABILITY: The 1604/1604-A continues to log an unusual history of "uptime." Why? The people from Control Data have been making computers for a long, long time. Their experience, their reputations are built into every Control Data computer. Your confidence has been their objective, peer demands have been their guide. This is why the 1604/1604-A proven records set a high standard of performance.

SOFTWARE: With the Control Data 1604/1604-A

Computer come proven programming systems that grow with your needs. These systems include PERT • COBOL* • CODAP • CO-OP MONITOR • LINEAR PROGRAMMING • ALGOL* • FORTRAN 62 • FORTRAN 63*.

These systems will also be compatible with the 3600 Computer. Additionally, proven programming systems (including JOVIAL) are available through the Co-op users organization.

SERVICES: A wide range of proven services come with the 1604/1604-A. These include Programming Assistance • Programmer and Operator Training • Programming Systems Improvement • Installation Check-out • Post Installation Assistance • Systems Analysis • On-site Customer Engineering.

APPLICATIONS: The power, versatility and usefulness of the Control Data 1604/1604-A Computer are demonstrated by the many users who rely upon its proven problem-solving capabilities. Real-time, on-line data reduction/data acquisition, large-scale problem-solving, large-scale data processing, biomedical and institutional research, weather prediction, oceanography, petroleum reservoir analysis, and flight simulation to name a few. Names of these satisfied users are available to you through the Control Data office near you.

LOW-COST: The Control Data 1604/1604-A is available today at an amazingly low cost. With its proven performance, programming systems and services, the Control Data 1604/1604-A offers the most computer for the least dollars spent.

These are the main reasons why so many computer users prefer the Control Data 1604/1604-A. To learn more about how the 1604/1604-A can solve your computing problems now, contact the Control Data representative nearest you.

*Available in early 1967

Atlanta • Albuquerque • Beverly Hills • Birmingham • Boston • Chicago • Cleveland • Dallas • Dayton • Denver • Detroit • Evansville • Houston • Kansas • Kansas City • Knoxville • Los Angeles • Miami • Minneapolis • New York • Philadelphia • Phoenix • Portland • Raleigh • St. Louis • San Francisco • Seattle • Springfield • Tampa • Washington, D.C. • Wichita • York/Hatfield • Zurich

6100-1415 Avenue South
Minneapolis 26,
Minnesota

CONTROL DATA
CORPORATION



A window that's for the birds...

The successful bird impact test of an unheated, all plastic transparent self-cleaning window, in full or heavy outdoor high altitude flight has been completed by Swedlow. Test conditions simulated 20,000-40,000 ft cruise altitude —50° outside air temperature and +32° inside temperature. Three staged impact to 10,000 ft and 400-mph impact at 4 lb. bird. Only minor damage amounting to slight spalling of the plastic around test frame mounting bolts resulted. Swedlow applied ingeniously developed thin new, self-cleaning, lightweight, low cost panel. Swedlow can solve your problem, too. Write or telephone today for complete technical information.



Swedlow Inc.
2000 West 10th Street, Los Angeles 44, California 90024
AIRCRAFT TRANSPORTATION • AEROSPACE • ELECTRONICS • POWER • COMMUNICATIONS



* Clear ply of 1/4" thick Swedlow multi-axis switched acrylic. Four aluminum corner plys of 1/2" switched acrylic with newly developed 20,000 psi castable couplings.

***** FILTER CENTER *****

► **Microelectronic Techniques Meeting:** Revising history this film and associated microelectronic techniques for industry acceptance may come to completion except the few techniques to take advantage of the inherent advantages of each (AW Mar 19, p. 57). One truth is the wind is the fact that Fairchild Semiconductor Division, a pioneer in microconductor technology, now is seeking this film recognition with the objective of combining both techniques. Trans Instruments and Westinghouse Electric, two other semiconductor microconductor producers, also have in house their own capabilities. Schwann Electric, which has published in this film its accomplishments, soon will announce critical semiconductor microelectronic with operating speeds far above anything now on the market. Networks is making head with strong capabilities in both techniques.

► **From IRE Convention:** Number of technical sessions sponsored or cosponsored by Institute of Radio Engineers during the next six months totals 26, a decrease of about 15% from the number it sponsored during the more recently period two years ago.

► **RADC Tests Angles Diversity:** The personnel intended to determine the possible advantage of using angular diversity to obtain more reliable long distance radio communication are under way at the Rome Air Development Center. Transmission terminal consists of a 25-ft dia. parabolic reflector containing seven feed horns, each powered by its own transmitter, which produce seven beams, each emitting at a slightly different angle. Receiving is made consists of two parabolic segmented antennas, each with seven feed horns and using low-noise parametric amplifiers. Equipment was developed by MIT Federal Laboratories.

► **Moletown Factory Planned:** Westinghouse Electric is building \$6,000,000 in facility near Baltimore to manufacture microelectronic semiconductor microconductor, with operation scheduled to begin in the spring of 1983. Activities formerly carried on at the Air Force Research and Development Center, at Youngwood, Pa., will be consolidated at the new facility. Employment initially is expected to total several hundred.

► **NREL Develops Ultraviolet Laser:** Naval Research Laboratory scientists report they have achieved laser emission at a wavelength of 3,125 angstroms from pulsed semiconductor laser glass.



Multiple winding of coils is one of the processes used by Wheeler in its unprecedented facility for the continuous production of high-voltage transformers.

IDENTICAL TWINS OR IDENTICAL THOUSANDS

Wheeler's family of Minuteman high reliability transformers

Regardless of quantity, Wheeler's new controlled-environment facility produces identical high-reliability transformers. For instance, completely homogeneous transformers with an objective failure rate of 0.01% per thousand hours with a 60% confidence level are now being made for the U.S. Air Force Minuteman Missile. Cost, humidity and temperature are regulated and monitored, meeting specifications and controls govern all processes from raw materials to packaging.

SPECIAL PRODUCTION METHODS—A special control of simultaneous multiple coil winding guarantees precisely the same number of turns and the same winding length on each coil, then ensuring accurate enough dimensions. This method permits a single insertion of inter-layer insulation in all the windings at once, greatly reducing possibility of variations from handling many separate sheets of insulation. Improved winding of lead coils contributes to consistent production of identical units. Winding is done by NASA spin test machine to sustain highest quality.

EXACT REPEATABILITY ASSURED—Every operation in manufacturing, testing, and quality control is detailed in writing and carefully followed by every operator to achieve exact duplication. Documentation of each step immediately permits any discrepancies.

For transformers of the highest reliability, produced under the most exacting specifications, contact Wheeler. Our experienced well-qualified engineers will skillfully interpret your requirements.



Division of Sperry Rand Corporation

Transformers, Power Supplies,
Communication Equipment,
Approved Environmental
Test Facilities.

150 East Aurora Street, Watertown 20, Connecticut • Telephone: 784-8101

the NEW
BETA™
with the "SIXCES" RECESS"
**a high strength
Blind Fastener**



The Beta Bolt — an excellent fastener for blind or close-out applications in wings, fuselage or other restricted structural areas. The 3-piece fastener assembly has excellent mechanical strength values, exceeds Mil Specs for vibration resistance because of its patented locking method and withstands measured test levels to 160 doublets. Shanks are ground to insure a uniform tightness in non-hole filling applications.

Three head styles are offered: an ANSBO style to permit direct substitution with similar headed blind fasteners, a conical disk for use in thin gauge material and a protruding style designed for minimum protrusion. Nominal shank diameters range from 5-32 thru 3-8 while a salvage oversize 1-64 series is also available. Gap lengths are in 1-64 increments with an additional built in 1-32 gap for unexpected variations in work thickness. Beta Bolts are offered in alloy steel (180,000-200,000 psi

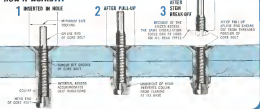
strength) and A-356 configurations. Other Beta Bolt series in 7075-T6 aluminum alloy, titanium and other aerospace approved and strength alloy are nearing the production stage.

Simple Adapter and Torque Driver tooling when combined and fitted straight and 90° standard power screwdrivers, engage the unique "sixces" recess to install the Beta Bolt with a considerably less initial load tension by the operator than normally required to install conventional threaded fasteners.

Write for our new 20-6 page brochure describing the Beta Bolt and its installation methods.

hi-shear CORPORATION
2600 WEST 80TH STREET • TORRANCE, CALIFORNIA

how it works...



the same base material previously used with silver base anodes to obtain corrosion in the retorted specimens. Now last, operating at about 1000 degrees, gives 35 angstrom wide fluorescence reaction which peaks at 8,125 Å.

• **AFCRIL Captures Lightning Strikes**—Air Force Cambridge Research Laboratory has successfully "captured" two lightning strikes by lowering them down 1,900 ft. of wire coated cloth by slip-launched rockets during a squall in the Caribbean. Each of the two lightning strikes exposed the wires, but not before AFCRIL scientists made measurements indicating they had generated currents of 30,000 amperes. The experiments are part of a program to learn more about very low frequency (VLF) radio signals generated by lightning strikes and to investigate possible use of the ionized path produced by the ropes and wires to serve as an antenna for VLF signals.

• **USSR Uses "Kash-Edg" Effect**—Soviet Union reports that it has developed and successfully put into practice the basis of a theory for the propagation of ultra short radio waves in magnetron. It has been confirmed that radio waves, coming into contact with the tips of ionospheric, start around them. This makes it possible in certain confined spots, without expensive accelerating stations, to receive long range radio and television broadcasts. The technique has been successfully and economically exploited in a wide network of mountainous radio radio stations, the USSR reports. The Soviets are not clear whether they claim to have discovered this principle, which has been widely known for some years in the U.S. as the "knowledge effect." It was extremely insightful several years ago by the National Bureau of Standards, which subsequently reported its findings.

• **Call for Nation Reports**—Prospective authors who would like to present papers at the 1963 National Aerospace Electronics Conference (Naecon) in Dayton, May 12-15, should submit 500 word abstracts and biographical data by Dec. 1 to Dr. Walter L. Koehn, 1939 Skaneateles Drive, Yonkers, New York.

• **Signal on Dated Line**—Motor contract awards recently announced by various manufacturers include the following:
• **Ford Motor Company's Automotive Division**, Newport Beach, Calif.—Air Force contract to investigate optimum methods for dispelling bubble damage (aerobation), sponsored by Rome Air Development Center.
• **Massachusetts Corp.**, New York

City—\$174,445 contract to develop computerized data storage and retrieval system incorporating feedback techniques to improve performance, from the Federal Aviation Agency.
• **General Electric, Technical Mission Planning Operations** (Tempro), Santa Barbara, Calif.—\$1,614,500 contract from AF Electronics Station Division for studies on information processing in command and control.
• **Los Angeles, Inc.**, Instrument Division, Grand Rapids, Mich.—\$525,510 for resistance attitude indicating systems for use on B-57D, from USAF's Aeronautical Systems Division.

• **National Cash Register Co.**, Dayton—\$90,000 contract from Aeronautical Systems Division for modification and calibration of various speech recognition techniques, in cooperation with Digital Voice Communication Laboratory of AF Cambridge Research Laboratories.
• **General Precision, Inc.**, Link Division, Binghamton, N. Y.—\$1.7 million contract for an electro-optical instrument capable of measuring angles to within 0.1 second of arc, equivalent to being able to aim a solar beam to within two feet of a satellite at an altitude of 1,000 mi. Contract is from NASA's Marshall Space Flight Center.

LAVELLE SHEET METAL WELDMENTS AND ASSEMBLIES

FOR SPACE VEHICLES AND MISSILES • JET ENGINES AND

AIRFRAMES • ELECTRONIC SYSTEMS AND GROUND SUPPORT

FACILITIES ARE PRODUCED TO EXACTING SPECIFICATIONS BY

CERTIFIED CRAFTSMEN EMPLOYING GOVERNMENT APPROVED

METHODS AND EQUIPMENT. MAJOR

CONTRACTORS RELY ON LAVELLE

FOR CRITICAL AEROSPACE COMPONENTS... PRECISION WELDED,

MACHINED AND PROCESSED IN STAINLESS STEEL •

TITANIUM • ALUMINUM • MAGNESIUM • NICKEL ALLOYS.

Write for brochure detailing Lavelle quality controlled services:

engineering • production planning • tool making • sheet metal

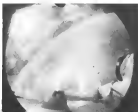
forming • welding • machining • metal preparation and finishing.

Lavelle
LAVELLE AIRCRAFT CORPORATION • NEWTOWN, DUKES COUNTY, PA.
Between Philadelphia, Pa., and Trenton, N. J.



Wide-Angle Camera Records Atlas Booster Separation

Wide-angle camera, mounted externally on an Atlas vehicle, recorded recently from the Atlantic Missile Range photographed a 90-m. view of the earth's horizon. Booster, foreground, is shown just prior to separation. Bottom left nozzle and flame partially obscure all sections of booster. Separation is completed; bottom right, contains engine nozzles in fire. White dots (upper left) are reflections on quartz glass through which photos were taken. Camera 114C, 8 quoted from Atlas as field using a parabolic dish. The wide-angle camera is housing can be removed on land or water.



SPACE TECHNOLOGY

Large Graphite Nozzle Cylinders Formed

By Donald E. Fink

New York—Four graphite cylinders, large enough to form nozzle liners for National Aeronautics and Space Administration's proposed 160-in. solid rocket motor, have been fabricated by Union Carbide Corp.'s National Carbon Division.

Cylinders will measure 105 in. outside diameter, 16 in. inside diameter and 50 in. long when they complete the end-down phase of the 12-month fabrication process only in November.

New facilities, recently installed at National Carbon's Niagara Falls, N. Y., plant during a \$6-million expansion and modernization program, were used to fabricate the cylinders, which the company says are the largest graphite pieces ever formed.

Feasibility Study

Fabrication is the second phase of a three-phase feasibility study sponsored by a contract from Rocket Research Laboratories of USAF Systems Command's Space Systems Division. Contract calls for three cylinders, but a fourth is being fabricated as a spare.

First phase of the program called for modification of mass production facilities to handle the large cylinders. The third phase will involve destruction testing of at least two of the cylinders to determine their properties. Also under phase three, the feasibility of using ultrasonic and electronic techniques for non-destructive structural testing of such large shapes will be investigated.

While the primary aim of the program is first to determine the feasibility of making graphite in large pieces and then to test its qualities, I. E. N. Townsend, manager of aerospace products for Union Carbide, said the 105-in. cylinders are large enough to form nozzle liners for the 160-in. motor NASA wants developed (AW Sept. 17, p. 17).

Nozzle diameters for the big booster will vary from about 120 in. to about 160 in. outside diameter, depending on nozzle design, but Townsend and Theodor and Acetel General, leading contractors in the 200-in. motor program, both have said the 105-in. size could be adapted to a test motor.

Two of the cylinders will be suited to destruction, but the third and possibly the fourth will be available for the final nozzle forming process. This will involve machining the inside of the cylinder to form a throat contour. The

work would be a nondestructive, uncooled nozzle lining of heat and erosion resistant graphite. The last three would be caused in a plastic or metal container to form the complete nozzle assembly.

Test cylinders are made of grade GFW unimpregnated graphite, which has a density of about 112 lb./cu. ft. Section 45-in. nozzles were fabricated from grade GFW and tested with large solid motors. According to Townsend, the test liners showed a low rate of erosion during exposure to temperatures in the 5,000 to 6,000°F range for periods up to 120 sec.

Production of the 105-in. cylinders required a major expansion of standard graphite production processes. Steel molds, 101-in. dia., with 12-in. dia. mandrels, had to be built. The green carbon mold pieces measured 101 in. outside diameter, 10 in. inside diameter and 85 in. long. During the baking and graphitizing process, however, the cylinders shrink and expand several times. The completed cylinders,

therefore, are expected to meet exact specifications.

Inside diameter of the cylinders was chosen as an arbitrary figure, Townsend said. A solid case could have been machined, but the hole in the center makes it easier to handle the 40,000-lb. pieces. It also provides a starting point for the throat machining process.

Throat Forming

Townsend said graphite's machinability, comparable with that of hard-wood or aluminum, will make the throat forming process relatively simple. Throat diameters may be as large as 90 to 120 in., depending on the outside diameter of the nozzle and the throat volume desired.

Cylinders could have been milled with inside diameters close to the final desired throat contour, he said, but the thick-walled cylinders are easier to mill and handle. Material lost in the machining is not a significant factor in the overall cost.

Most large boring mills could tool to



GREEN CARBON CYLINDERS, measuring 105 in. outside diameter, are shown in National Carbon Co.'s new brick oven. Finished graphite cylinders will measure about 105 in.

U.S.A.F. F-104 WINS AIR FORCE FIGHTER WEAPONS MEET

The Tactical Air Command has a new champion. In a world-wide competition among TAC fighters, the F-104 Starfighter carried off top honors in the William Tell A.F. Fighter Weapons Meet at Nellis Air Force Base, Nevada.

The F-104 pilot, Captain Charles E. Tofferi, of the 479th Tactical Fighter Wing, cinched his victory with 3 perfect scores in such vital events as strafing, air-to-ground rockets, and napalm drops. In the single air-to-air event, he set a new record, completely destroying his target in 63 seconds. His winning total for all events was 19,018 points—out of a possible 24,000.

Captain Tofferi's brilliant performance

proved what the F-104 can do. F-104 pilots all over the world know *the F-104 is a most effective all-around fighter*. It meets the TAC mission of close ground support and interdiction, with the same mastery it shows in air superiority missions.

The Lockheed F-104 is not so much a single weapon as an extremely stable platform which can adapt itself to almost any fighter weapons mission. Six of our allies chase the F-104 over every other jet in the world. It is now being produced in 7 nations for 11 air forces, including the U.S.

Captain Tofferi has demonstrated once again the reasons for this overwhelming vote of confidence.

LOCKHEED-CALIFORNIA COMPANY

A DIVISION OF LOCKHEED AIRCRAFT CORPORATION • BOSTON, CALIFORNIA



handle the throat necking, but Natural Carbon will soon have its own mill operating in the Niagara Falls plant addition. Other new facilities include a natural gas furnace, which can take four of the 118 in. cylinders simultaneously, and a melting press capable of forcing cylinders up to 248 in. dia.

In addition to the four large rollers, Natural Carbon also has fabricated 60-in. cylinders for United Technology Corp., recently chosen to develop the 130-in. segmented solid motor for the Titan II launch vehicle. Tensoned and several cylinders have been delivered to UTC for testing. Others are now being fabricated to create a backlog for rapid filling of subsequent orders.

Canadian Missile to Be Fired From Naval Gun

Canadian Martlet I missile prototype, designed for upper atmosphere research, will be launched from a converted cruiser soon. 16-in. U.S. naval gun late in November from the ship at Barbados, British West Indies.

Five kips of this 60-in., 550 lb. missile are designed to prove the feasibility of shooting a missile from a gun rather than using rocket propulsion. McGill University, Montreal, is manag-

ing the project and will use its high altitude research facility at Barbados as launch site.

Martlet, which is designed to reach altitudes from 200,000 to 140,000 ft., is guided during the drag stage in two dimensions and glass fiber sheets enclosing the front and rear of the fins do, precisely. The subjets, which are the same diameter as the bore, prevent buffeting and assure the gas stabilization fins of the vehicle. Air pressure pushes off the subjets after the missile leaves the gun barrel.

Missile velocity will run from 5,000 to 7,000 fps, depending on altitude desired. A near vertical deflection of 85 deg. will be used. Pioneer heading for the project comes from two U.S. sources, the Advanced Research Projects Agency and the Army Ordnance Missile Command.

Technical data of pitch and yaw only will be recorded on the first test flight. Following successful test flights, McGill wants to develop the missile further in an upper atmosphere research vehicle.

Consulting Division of Canada, Ltd., Ottawa, Ontario, is building the test-launching equipment and is expected to receive the contract to build the vehicle also if the kips prove successful and the project is continued. McGill University is constructing the prototype vehicle.

NASA Contracts

National Aeronautics and Space Administration has recently awarded the following contracts and research grants. The figures shown represent the total estimated cost of contracts of \$50,000 or more let during the period.

COGNEVED SPACE PUMPER CENTER, GREENBERG, MD.
Pumpkin Seed Motor Test No. 10, 10-in. bore. To develop test for liquid slush pump slush test.

Manufacturer: Inc., Ontario. Pto—\$10,000. 100,000, only developing agent could contract.

AR Space Systems Command, Aeronautics Division, Greenberg, MD.
To develop test for liquid slush pump slush test.

WALLACE STATION, WALLACE, N. H.
To develop test for liquid slush pump slush test.

WALLACE STATION, WALLACE, N. H.
To develop test for liquid slush pump slush test.

WALLACE STATION, WALLACE, N. H.
To develop test for liquid slush pump slush test.

WALLACE STATION, WALLACE, N. H.
To develop test for liquid slush pump slush test.

WALLACE STATION, WALLACE, N. H.
To develop test for liquid slush pump slush test.

WALLACE STATION, WALLACE, N. H.
To develop test for liquid slush pump slush test.

WALLACE STATION, WALLACE, N. H.
To develop test for liquid slush pump slush test.

WALLACE STATION, WALLACE, N. H.
To develop test for liquid slush pump slush test.

WALLACE STATION, WALLACE, N. H.
To develop test for liquid slush pump slush test.



Vibration Test Performed on Delta Vehicle

Fully assembled Douglas Delta space vehicle undergoes a vibration test at Douglas Missile and Space Systems Division, Santa Monica, Calif. Test determines control stability and body loading modes of the 80-ft. long, 1,428 lb. vehicle.

CURTISS-WRIGHT ELECTRONICS...

adding a new dimension to the capability of man



PROJECT IN POINT:

This Polaris launch crew

thinks it is 40 fathoms deep!

Simulation reflects the ultimate in the application of science and technology. It is the most intense bridge from research to reality. At Curtiss-Wright, electronic simulation systems orient men and machines to missions for many military and industrial programs.

Project In Point: Today at the Navy's New London submarine school, Polaris launch crews are being oriented by the largest, most complex, fully-digital simulator in use for any training application. Designed and manufactured by Curtiss-Wright, the simulator not only trains new crews but polishes the skill of Polaris veterans as well.

Short of operational experience at sea, no other training method is as practical.

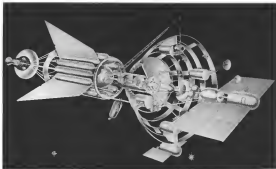
These and additional advanced activities in related fields have created immediate opportunities at Curtiss-Wright Electronics Division for self-study circuit designers, digital computer programmers and others experienced in the application of real-time digital computers to challenging simulation problems.

For information, write Mr. Gene J. Kelly, Manager of Professional Placement, Electronics Division. An equal opportunity employer.



ELECTRONICS DIVISION
CURTISS-WRIGHT CORPORATION

35 MARKET STREET, EAST PATERSON, N. J.



Maintenance Station Envisioned for Nuclear-Powered Spacecraft

Vehicle of the type shown in this artist's concept was suggested recently by Westinghouse Electric Corp.'s astronautics laboratory as a potential maintenance, repair and refueling center for nuclear-powered spacecraft. Concept shows self-propelled space ship for radioactive equipment (right). Shielded personnel quarters are in the center, and the maintenance station propulsive system is at left.

SPECIFIED FOR RELIABILITY

In the conquest of space, high speed test stands have been measured with S-N speed indicator units. For exposures to 9500 RPH and for output speeds to 95,000 RPM, specify S-N for reliability.



SN
SPEED
INCREASES
UNITS
SHOW-NABSTEDT GEAR CORP.
101 WILTON ST. HANSON, IOWA

PRODUCTION BRIEFING

Airpower, Inc., Newport Beach, Calif., is designing mobile vehicle for profile use in solid electrolyte fuel cells. Work is financed by a \$68,000 National Aeronautics and Space Administration contract. Vehicle, containing an electrolyte made of a synthetic rare gas membrane composed between two thin metallic layers, are expected to operate in many kinds of fuels and oxidants, must oxidize and perform under zero gravity conditions.

Low Siegel, Inc., has received a \$792,000 subcontract from Gates-Wright Corp. to produce rocket case sections by the last step of the Minuteman (ICBM). Work will be done at the Aero Structures Division, El Segundo, Calif., on its production equipment.

Douglas Aircraft Co.'s Missile and Space Technology Division has secured a contract approximating \$75 million for continued research and development of Army's Nike Zeus anti-missile missile. The contract represents Douglas' portion of a \$145-million Army contract recently awarded to Western Electric Co., prime Zeus contractor (AVW Oct. 5, p. 47).

Astronauts Mike Sme Co.'s Aerospace Division, Glendale, Calif., has received a \$1.5 million contract from McDonnell Aircraft Corp. to build hydraulic pumps for the F-110, Air Force's version of the P401 Phantom jet.

Daniel, Inc., Chicago, Ohio, will build several mechanisms for precision entry hatch and protection devices for lunar moon vehicles at McDonnell Aircraft Corp. contract for approximately \$1.3 million.

Kelvin Electric Co., Van Nuys, Calif., will produce precision mechanical systems for use on the Gemini mission spacecraft. Work is financed by a contract from International Business Machines Corp.

Haydon Alaskan Co., Culver City, Calif., has been awarded a supplemental Air Force contract for \$1.7 million to continue development of a fire control system for the GAR-9 Falcon missile.

Kaiser Aircraft Corp., (Bloomfield, Conn.) has purchased Power Transmission Systems, North Caldwell, N.J., which specializes in production of gears

and power transmissions for aircraft. Purchase was made with cash and Kaiser stock.

Brown University will conduct research in re-entry phases under a \$166,000 contract awarded by the Advanced Research Projects Agency and the Office of Naval Research. Purpose of the present study will be to gain basic knowledge for the design of KIRM detecting and tracking devices which will discriminate between debris and actual warheads. Solution of the engineering problems of detection systems will not be attempted, but physical phenomena basic to such systems will be investigated both theoretically and experimentally.

Telconsporing Corp.'s Power Sources Division, Los Angeles, Calif., has been awarded an Air Force contract to develop and produce accurately activated, aluminum primary batteries to supply airborne electrical power for ring safety systems in space vehicle homing. Batteries are designed to operate in 15 sec. and operate in temperature from -50° to 150°.

Douglas Aircraft Co.'s Donald W. Douglas Engineering and Product Development Center has been officially dedicated at Long Beach, Calif. The research and development facility has 665,000 sq. ft. of floor space and a hangar on the roof. The facility's administration building is nearing completion.

Nuclear extension of the Atomic Energy Commission's National Aeronautics and Space Administration Space Nuclear Propulsion Office has been opened in Las Vegas with Robert P. Hoffman as chief.

Bureau of Naval Weapons has awarded development study contract to Sandstrom Aviation-Devises, for a solar-dynamic satellite power system, capable of producing 1.5 kw. of power. Sandstrom, which is developing a 10-kw. solar-dynamic engine for Air Force wing launch vehicles, noted in working fluid, will use a low temperature engine current as working fluid as the Navy system.

Avco Corp. of Englewood has awarded an \$83,960,000 contract to Morton-Kovats Co., Inc., of Buena Vista, and has awarded construction for construction of underground launch facilities for 208 Minuteman ICBMs near Warner, Ariz., Chusapa, Wis. Included are 250 launch tubes and 15 underground control centers. Work is also to be under way October and the entire 200 are to be finished in September 1964.

Callery fits your high energy needs

with these three high-performance headliners

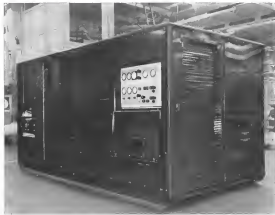


Today's missions call for the outstanding performance you can achieve with Callery's borane fuels and NP oxidizer. For technical data, price quotations and delivery schedules from a pound to tons, call, wire or write: Callery Chemical Company, Defense Products Department, Callery, Pennsylvania. Evans City (Pa.) 3520. Offices in Washington, D.C., Van Nuys, California; and Dayton, Ohio.



Visit Callery at Booth 422
ARS 17th Annual Meeting
Las Angeles—Nov. 13-16

The free world's only borane fuel capability



Automatic temperature control GSE for Titan II missile propellant

This new environment control package was designed and produced by Hamilton Standard for the Air Force's Titan II missile, made by Martin. It automatically stabilizes propellant temperature at $69 \pm 5^\circ\text{F}$ within a 30,000 gallon storage vessel. The unit electrically heats or mechanically cools a glycol and water heat transfer liquid, and then circulates it to the storage vessel heat exchanger. It is built to perform reliably in ambients of -35° to $+115^\circ\text{F}$, and from sea level to 6,000 feet.

The Titan II Propellant Temperature Controller is evidence of Hamilton Standard's ability to meet

environment control GSE assignments. It typifies the results attainable when engineering capabilities in pneumatic, hydraulic, electronic, and packaging, are combined with specialized manufacturing skills.

A NEW BROCHURE describing Hamilton Standard's environment control GSE capabilities for aircraft and missiles is available. To learn how this solid foundation of experience can be your key to dependable GSE, write: Sales Manager, Ground Support Equipment Department, Hamilton Standard, Windsor Locks, Connecticut.

Hamilton Standard

DIVISION OF UNITED AIRCRAFT CORPORATION



AIRCRAFT & INDUSTRIAL ENGINE CONTROLS • ENVIRONMENTAL CONDITIONING SYSTEMS • GROUND SUPPORT EQUIPMENT • TURBINE STARTERS
JET FUEL POWER GENERATORS • STATIC POWER SYSTEMS • AUTOMATIC BRIDGELAND SYSTEMS • SECTION BEAM MACHINES • PROGRAMS

FINANCIAL

New Offerings

Control Data Corp., Minneapolis, Minn., engaged in the design, development and manufacture of systems, equipment and computers used in electronic data processing and automatic control for military, scientific and industrial uses. Offering a \$15,000,000 of convertible subordinated debentures, due 1977. The proceeds of the debentures will be used in part to pay outstanding bank loans.

Tecton, Inc., Providence, R. I., a metals industry manufacturing company with an major product group including defense. Offering a \$2,000 authorized common shares by Howard Kellogg and Davis K. Noble, as trustee of a certain trust.

American Brake Shoe Co., New York, N. Y., presently engaged in the manufacture of components, machinery and equipment for the manufacturing and transportation industries. Offering a \$11,000,000 of subordinated debentures, due 1987. Proceeds will be used for general corporate purposes, including capital improvements estimated at \$17,500,000 by 1982.

General Acoustics, Inc., Cincinnati, Ohio, engaged in the development of, and has arranged for the manufacture of, equipment for ground-based control of jet aircraft; it has developed two turbojet engines for such use; it has also developed and is currently manufacturing and marketing a variety of acoustic and electronic systems. Offering a \$20,000 capital stock, \$10,000 shares by the company, and \$10,000 subordinated shares by the holders. Of the company's proceeds, \$115,500 will be used to pay certain debts and accounts payable, \$110,000 for accounts payable for one year for the holding companies in White and Blackwood, \$810,000 to design test and produce models of the equipment for jet aircraft ground movement, the balance of the proceeds for corporate use to White and for general corporate purposes.

Seltzer Drivens, Inc., Nassau, N. Y., engaged in the design, development and manufacture of astronomical instruments consisting of optical systems used in integral components of astronomical instruments and in electronic drives. Offering a \$5,215 subordinated common shares by the holders.



LOW-AMP 3-PHASE CIRCUIT BREAKER RESISTS 500CPS VIBRATION AT 10G!

This compact package integrates three miniature push-pull circuit breakers to bring unprecedented 3-phase protection to electronic components and cables in the 10 to 10 amp range. An overload on any one phase trips all three breakers—and releases the single indicating button. While the button stays in, everything's "A-OK".

Tripping response is comparable with the speed of a slow-blow fuse... 2 to 20 sec at 200% rating. Since the KLIXON 7276 breaker is thermally responsive, it avoids nuisance trips on harmless current transients.

For complete performance and test data on the new KLIXON 7276 3-phase circuit breaker, write for Bulletin CIRB-37.

PERFORMANCE CHARACTERISTICS

Reference voltage	100 volts, ac/dc
Rated temperature	100 degrees, maximum
Breakers of three-amp range	Terminal: 30-Watt, Breaker: 40-Watt
Breakers of 10-amp range	40-Watt, maximum only
Tripping time	At 110% rated 10% up to 10% rating
At 120% rated 10% up to 10% rating	At 120% 10% up to 10% rating
At 130% rated 10% up to 10% rating	At 130% 10% up to 10% rating
At 140% rated 10% up to 10% rating	At 140% 10% up to 10% rating
At 150% rated 10% up to 10% rating	At 150% 10% up to 10% rating
At 160% rated 10% up to 10% rating	At 160% 10% up to 10% rating
At 170% rated 10% up to 10% rating	At 170% 10% up to 10% rating
At 180% rated 10% up to 10% rating	At 180% 10% up to 10% rating
At 190% rated 10% up to 10% rating	At 190% 10% up to 10% rating
At 200% rated 10% up to 10% rating	At 200% 10% up to 10% rating
At 210% rated 10% up to 10% rating	At 210% 10% up to 10% rating
At 220% rated 10% up to 10% rating	At 220% 10% up to 10% rating
At 230% rated 10% up to 10% rating	At 230% 10% up to 10% rating
At 240% rated 10% up to 10% rating	At 240% 10% up to 10% rating
At 250% rated 10% up to 10% rating	At 250% 10% up to 10% rating
At 260% rated 10% up to 10% rating	At 260% 10% up to 10% rating
At 270% rated 10% up to 10% rating	At 270% 10% up to 10% rating
At 280% rated 10% up to 10% rating	At 280% 10% up to 10% rating
At 290% rated 10% up to 10% rating	At 290% 10% up to 10% rating
At 300% rated 10% up to 10% rating	At 300% 10% up to 10% rating
At 310% rated 10% up to 10% rating	At 310% 10% up to 10% rating
At 320% rated 10% up to 10% rating	At 320% 10% up to 10% rating
At 330% rated 10% up to 10% rating	At 330% 10% up to 10% rating
At 340% rated 10% up to 10% rating	At 340% 10% up to 10% rating
At 350% rated 10% up to 10% rating	At 350% 10% up to 10% rating
At 360% rated 10% up to 10% rating	At 360% 10% up to 10% rating
At 370% rated 10% up to 10% rating	At 370% 10% up to 10% rating
At 380% rated 10% up to 10% rating	At 380% 10% up to 10% rating
At 390% rated 10% up to 10% rating	At 390% 10% up to 10% rating
At 400% rated 10% up to 10% rating	At 400% 10% up to 10% rating
At 410% rated 10% up to 10% rating	At 410% 10% up to 10% rating
At 420% rated 10% up to 10% rating	At 420% 10% up to 10% rating
At 430% rated 10% up to 10% rating	At 430% 10% up to 10% rating
At 440% rated 10% up to 10% rating	At 440% 10% up to 10% rating
At 450% rated 10% up to 10% rating	At 450% 10% up to 10% rating
At 460% rated 10% up to 10% rating	At 460% 10% up to 10% rating
At 470% rated 10% up to 10% rating	At 470% 10% up to 10% rating
At 480% rated 10% up to 10% rating	At 480% 10% up to 10% rating
At 490% rated 10% up to 10% rating	At 490% 10% up to 10% rating
At 500% rated 10% up to 10% rating	At 500% 10% up to 10% rating



METALS & CONTROLS INC.
NEW JERSEY ST. AFTERBORN, MASS.
A CORPORATE DIVISION OF
TEXAS INSTRUMENTS
INCORPORATED



CF700
TURBOFAN
4390 LBS. THRUST
(Development)



CJ610
TURBOJET
3850 LBS. THRUST
(FAA Certified)



J85-5
TURBOJET
2850 LBS. THRUST



J85-7
TURBOJET
2450 LBS. THRUST



T64-4
TURBOPROP
2850 HORSEPOWER



T64-6
TURBOSHAFT
2650 HORSEPOWER



T58/CT58
TURBOSHAFT
1750 HORSEPOWER
(FAA Certified)



BOEING SB-3A
Army AH-1
T58



HONEYWELL T-5A
Army Apache
J85-5



HONEYWELL VERTOL
Army
CT58



AERO Commander 1190
General Atomics
CJ610



SUKHOI SU-26
Soviet Union
T64-6



SUKHOI SU-26
Soviet Union
T58



SUKHOI SU-26
Soviet Union
T58



SUKHOI SU-26
Soviet Union
T58



F4U CORSAIR
Army
J85-5



BOEING STEARMAN
Army
CT58



BOEING STEARMAN
Army
J85-5



BOEING STEARMAN
Army
CT58



BOEING STEARMAN
Army
CT58



BOEING STEARMAN
Army
CT58



BOEING STEARMAN
Army
CT58



BOEING STEARMAN
Army
J85-5



BOEING STEARMAN
Army
CT58



BOEING STEARMAN
Army
CT58



BOEING STEARMAN
Army
CT58



BOEING STEARMAN
Army
CT58



BOEING STEARMAN
Army
CT58



BOEING STEARMAN
Army
CT58



BOEING STEARMAN
Army
CT58

POWER THEM ALL

For additional engine information, or, for a full
short copy of this ad suitable for framing, write to:
General Electric Information
SAE—General Electric Company
Lyons, Massachusetts

SMALL AIRCRAFT ENGINE DEPARTMENT

GENERAL ELECTRIC

FLIGHT PROPULSION DIVISION

38-1

Financial Briefs

Mohawk, Inc., reported \$5.6 million for the first six months of 1962 on sales of \$138.6 million—compared with \$3 million and \$128.7 million, respectively, for the same period last year. Second quarter 1962 earnings totaled \$3.3 million on \$62.6 million sales. Same period last year showed \$1.2 million earned on \$68.3 million sales.

Thompson-Rousse Wheelbridge, Inc., had earnings of \$6.4 million on sales of \$211.6 million for the first six months of 1962. Same period last year showed

earnings of \$2 million on sales of \$208.9 million. Second quarter 1962 earnings were \$3.5 million on sales of \$119.4 million—compared with \$184,906 earned on sales of \$111.7 million at the same time last year.

B. F. Goodrich Co. reports net sales of \$496 million with earnings of \$11 million for the first six months of this year. Same period last year showed \$370.3 million in sales with a \$45 net loss profit.

General Controls Corp., had earnings of \$429,000 on sales of \$11.7 mil-

lion for the first six months of 1962—highest six months in the company's history. This year's figures were 12% above last year's. Order backlog stood at more than \$2.6 million on June 30 compared with \$3 million at the same time last year.

Trident Electronics, Inc., of Phoenix, Ariz., reports sales of \$14.4 million with earnings of \$999,000 for the first six months of 1962. Last year's figures for the same period showed sales of \$13 million with a net loss of \$198,900. Second quarter sales were \$7.4 million with earnings of \$449,000—compared with \$5.5 million sales and a \$123,000 loss for the same period, 1961.

Trident Plastic, of Ft. Worth, Tex., has acquired a controlling interest in Fly-A-Way Components Inc., of Bradwell, Okla., a manufacturer of "edge lighted" and printed circuit panels for aircraft and missile instrumentation. Fly-A-Way will move to Ft. Worth and be operated as a Trident subsidiary.

Rollin Aircraft Corp. reports a net income of \$81,613 on sales of \$1.6 million for the first six months of 1962. The figures compare with a \$142,968 net loss on sales of \$675,734 for the same period last year.

Bell & Howell Co. reports a 19% increase in earnings for the first half of 1962 above the figure for the same period last year. Six month earnings this year were \$1.5 million on sales of \$85 million compared with \$1.3 million earned on sales of \$68.5 million the same last year. Second quarter earnings were \$962,000 on sales of \$15.9 million. Second quarter, 1961, earnings were \$811,000 on sales of \$15 million.

Relatex, Inc., reports earnings of \$229,800 on sales of \$17.6 million for a 46% gain, period ended June 30. Comparable figures for the same period last year showed earnings of \$487,100 on sales of \$20.5 million. Homer R. Deery, president, told stockholders that in spite of a drop in sales, the company has a record \$16 million order backlog.

Baldwin-Lima-Hamilton Corp. reports \$70.9 million sales with earnings of \$1.3 million for the first half 1962. Same period last year showed \$55.8 million sales with its income of \$518,895.

Bowmar Instrument Corp., Ft. Worth, Tex., reported record sales of \$6,518,127 for the six months ended Mar. 31, 1962, more than double the previous year's six-month total of \$3,322,817. Net income rose to \$348,173 for the 1962 period, 80% above last year's \$187,385.

NOW AVAILABLE / NEW OSTER AVIONIC SYNCHRO CATALOG



This 16-page catalog, devoted exclusively to synchros, describes complete electrical parameters and mechanical characteristics of more than 175 Avionic synchros, including resistors, transmitters and linear synchros in sizes 8, 10, 11, and 25. Outline dimensions and physical features of 24 basic synchro configurations also are included.

For many references, one page is devoted to definitions of synchro parameters and basic nomenclature terminology.

OSTER AVIONIC DIVISION

JOHN OSTER MANUFACTURING COMPANY

RAVINE, ILLINOIS

A SUBSIDIARY OF THE **Stamco** CORPORATION

STAMP OUT YOUR ORDER

From Oster Mfg. Co., Ravine, Illinois

Please send me your NEW Oster Avionic Synchro Catalog.

NAME _____

COMPANY _____

CITY _____

STATE _____

MANAGEMENT MACHINE

Regardless of the transportation equipment you now employ, this business machine can double or triple the productivity of your management men on the move. The all-weather Jet Commander carries up to 6 passengers and the crew is protected, air-conditioned, heated... Runs at speeds above 300 mph... parts capable of doing virtually any airport, anywhere. The Jet Commander is the only one under a purchase agreement which guarantees performance and a 12 month warranty. Write for details of the Jet Commander, management machine of the future.



ASEO COMMANDERS, INC., BETHSANY, OKLAHOMA, Subsidiary of ROCCWELL-STANBARD CORPORATION



The 176 pound S-B environment test chamber is 510 inches tall and is used to simulate space environmental testing on the 500 kilowatt and 5000 watt Goddard "B" test.

"WORKHORSE" FOR GODDARD'S ENVIRONMENTAL TESTING

The Goddard "B" by 8" x 8" in diameter and 8 ft. long horizontal test chamber is one of the key elements in the reliability testing program at NASA's Goddard Space Flight Center, Greenbelt, Maryland.

This Stokes-designed and Stokes-built thermo-vacuum test was the first true space simulation facility installed at Goddard for testing unmanned vehicles under the fullest possible range of environmental conditions, and is the largest presently in use there. It has a vacuum capability of 1×10^{-7} Torr (200 mile altitude) under full load conditions, and is equipped with a heat transfer system capable of handling medium wall temperatures from -65°C to 100°C .

Goddard's "B" will continue to serve as the testchamber for the Space Flight Center's highly successful reliability testing program until the enormous test and evaluation facilities now under construction go into service early in 1963. Major space test chambers of this facility, which is expected to set the most advanced standards for spacecraft check-out, are two 30 ft. diameter, 60 ft. high thermo-vacuum environmental simulation. Stokes was selected as a prime contractor to NASA for complete vacuum and cryogenic systems for these large chambers.

We welcome your inquiries regarding our capabilities and facilities for designing, fabricating, and erecting simulation facilities well in advance of the state-of-the-art, or any portion of a simulation project requiring high-vacuum and cryogenic systems. Space Systems Department, F. A. Stokes Corporation, 2000 Fisher Road, Philadelphia 26, Pa.

STOKES INTERNATIONAL • PHILADELPHIA • TORONTO • LONDON

STOKES

MANAGEMENT

New Yorkers Protest Defense Work Decline

Washington—New York congressional delegation has urged the Defense Dept. to cooperate with the White House's Office of Emergency Planning on a program of regional military production and research and development facilities.

In a letter to Defense Secretary Robert S. McNamara, the delegation, headed by Rep. Emanuel Celler (D-N.Y.), pointed out that Edward A. McDermott, OEP director, has expressed concern over "serious threat" in mobilization planning and the concentration of defense industries. McNamara was asked for a report as to "whether some mechanism is being investigated at the highest levels to consider and take steps to counteract such concentration."

The New Yorkers pointed a decline of over 10% in fiscal 1962 from fiscal 1961, in the proportion of Defense Dept. business that went to prime contractors in their state. Awards to California increased over 12%, giving the state 24% of the total Defense Dept. business for fiscal 1962. New York's share of the total was 10.7%.

"We continue to feel the inordinate raising of government within one geographic area cannot be of ultimate benefit to the nation," the congressmen wrote McNamara. "Constantly, faced with the challenges this country faces, there should be over close consideration of deployment compatible with the national interest in the widest possible sense."

Government-Industry Changes Are Requested

San Antonio, Tex.—New concepts of government-industry relationships are necessary to permit the application of U.S. technical resources on both sides of the fence, Northrop grand vice president Richard E. Harner stated here during USAF's Annual Science and Engineering Forum.

Saying first "we have long admired the ability of government administration in the defense industry," Harner noted that today the defense industry has gone into one of the highest segments of the total U.S. economy and the need for this kind of government support no longer exists. He said its continuation compromises efficiency on both sides.

Harner pointed out that defense companies today spend an average of 4% of total sales on technical overhead, including R&D and proposal activity.

EHF
SHF
UHF
VHF
HF
ME
LF
VLF

"COMMUNICATIONS IS OUR MIDDLE NAME"

- A remote leader in command/controlled communication systems, Electronic Communications, Inc., maintains a continuing interest in all the radio spectrum.
- Currently we are engaged in a number of advanced projects... serving as the prime communication system contractor for AN/C-140A Airborne Command Post program... design, development and manufacture for NASA's Space Control Signal Processor and Flight Control Computer... in some test beds.
- For these projects and other long-range research and development work, ECI has resources for a skilled, creative team of interdisciplinary engineers with degrees in EE, ME, RF, VHF, UHF and SHF equipment, digital communications, information theory, antennas, modulation techniques and ground communication systems.
- If you are interested in a challenging career and want to work for a growing Company representative open at 31 Pennington and Titcomb, Mid-J. contract. Professional Placement, Electronic Communications, Inc., P.O. Box 12414.

ELECTRONIC COMMUNICATIONS INC.

1502 72nd STREET NORTH
ST. PETERSBURG 38, FLORIDA



an equal opportunity employer



New Power Systems Take Shape at Curtiss-Wright

What you see to the left are three uncommon shapes with a common purpose: putting power to work. More power—more efficiently, by means of new transmission systems developed by the Wright Aeronautical Division for a variety of land-sea-air equipment.

Under contract with the Bureau of Ships, a new transmission system is now being developed which will handle inputs of 40,000 HP for near-future use aboard 500-ton hydrofoil craft. As a major producer of precision gears and gear systems, Wright Aeronautical has received aircraft sub-contracts for the design-and-production of a new single drive mechanism that increases electrical capacity by as much as 30%.

Taxoidal-traction drives offer power transmissions

with a smooth infinitely-variable speed change—for military and industrial equipment—with a new order of fuel economy, overall efficiency, and grade-acceleration performance. Taxoidal drives are lightweight, quiet, and practically free of vibration. Evaluation contracts have been placed by the US Army and the Link-Belt Company.

For industrial pumps and for both military and commercial water craft, an advanced water jet propulsion system—unique in design-simplicity and rugged in construction—offers a most efficient means of propulsion.

These systems are the result of generations of experience at Curtiss-Wright in power transmissions. They can mean more power to you and your power transmission program. Our literature is available on request. Write for it.



**Wright Aeronautical Division
CURTISS-WRIGHT CORPORATION**

Main and Pennic Streets



Wood-Ridge, New Jersey



PUMP PRIMERS

ARTHUR A. NICHOLS

High Altitude Pumping Efficiency

Explainers concerned with the proper distribution of pump flow and performance at high altitude may find that problems are encountered. Pump which work well at low altitude frequently run into trouble when they encounter the rapid pressure changes, shock, and turbulence which provide training and lowered efficiency at high altitude.

Generator groups are often as high as 3,500 feet and therefore are frequently operated for this reason. A specialized form of internal gear pump, the generator has an extra toothed rotor and stator.



Operating under limited volume, the generator has one less tooth than the rotor and the resulting tooth space leaves a chamber for trapping the fluid from the rotor in the rotor port.

After opening and closing of the chamber as it traverses the large inlet and discharge openings, an evidence of the sudden shock and pressure change is a sudden turbulence which is often typical of pumps results in pumping and lowered efficiency. This generator pump offers considerably good performance at high altitude.

Some relative speed and closely built streamlines between the two diameters characterizes most high efficiency efficiency is characterized.

Low weight, high performance and unusual adaptability to space and geometry of housing structures. Generator pumps have no previous tube and generator design.

Engineers concerned with drive, auxiliary power systems, gear boxes and various transmission design problems found generator type pumps are usually useful in their attempt to build weight down and achieve maximum performance with high service reliability.

Applications for generator pumps are in the range of pressures up to 3,000 psi. They are suitable for low pressure hydraulic and servo systems, hydraulic control, tube, systems and hydraulic service, electronic control pumping in aircraft and related systems and similar applications.

Thinks and is available and your engineers is invited. Write:

W. H. NICHOLS CO.
Makers of Zephyr Molding Pumps and the Nichols Milling Machine
"The Miller that uses its head!"

48 MOORE AVE., WILMINGTON 34, MISS.

AERONAUTICAL ENGINEERING



Bede Aircraft BD-7 shortfield aircraft is built along same general lines as earlier XRD-2 experimental STOL aircraft. Aft fuselage has angled C-wing to explain a single propeller control inside an inside bag. Capacity is 24 persons.

Bede Aircraft Reveals First Design Details of Proposed BD-7 Airliner

First design details of the proposed Bede Aircraft BD-7 shortfield airliner show it to be built around the major aerodynamic features of the company's experimental STOL aircraft, the XRD-2 (AWE Feb. 18, p. 67).

Large flap area plus action boundary-layer control on the upper surface of the wing gas production increases lift coefficient to which should allow takeoff and landing speeds of 55 mph.

Pairs of General Electric CT33 turbo-prop engines, rated at 3,250 hp, each, are coupled to drive a single propeller mounted in an annular duct at the tail.

Basic configuration has 35 seats in the cabin. At the aircraft normal gross weight of 13,500 lb., internal fuel provides a 1,140-mi. range with a 45-min. fuel reserve, according to the manufacturer. In a high-density version, where 28 passengers and baggage are carried for the same gross weight, the range is reduced to 385 mi., with the same reserve.

Computers are now working on a detailed cost analysis of operations with the BD-7, using standard Air Transport Association standards. Calculations estimate a 100-mph stage length carrying 24 passengers. On this basis, the computer reports, the cost per seat-mile is relatively low at 34% less than comparable figure for the Douglas DC-8. Cost per available mile is calculated as 27% lower than the DC-8 cost.

Normal 15-passenger argument of

the interior seat seats in rows of three spaced at 48 in. pitch. This is reduced to a 36-in. pitch for the high-density version. Baggage compartment volume is 112 cu. ft.

Bede proposes an all-cargo version along with the passenger-carrying BD-7. It would have a speed over 70 mi. a hour, to give easy access to the cable cargo volume of 1,146 cu. ft.

Fuel load is 472 gal., carried entirely in the fuselage. Secondary wing structure: Maximum capacity of the wing tanks is 755 gal., and auxiliary tanks can be installed in the fuselage to bring the total to 845 gal. At normal gross weight, with full wing tanks and maximum tanks, the zero range of the BD-7 is estimated at 3,820 mi.

Performance data have been based on light test data from the XRD-2, which have been carrying 10,000 lbs. per year. They show a takeoff distance of 312 ft. over a 50-ft obstacle on a 100-ft dry. Time to climb to 25,000 ft. is 7.1 min.

At 25,000 ft., the cruise speed is 309 mph. Landing length over a 50-ft obstacle is 450 ft.

On a hot day, the single engine takeoff distance is 585 ft., over a 50-ft obstacle.

Maximum rate of climb on one engine is 1,150 fpm, and the stage length is 29,000 ft.

Wing span of the BD-7 design is 55 ft., over all length is 58 ft., and wing area is 430 sq. ft.

USAF Contracts

Following is a list of unclassified contracts as released by U. S. Air Force contracting offices:

Manpack Radio—The contract, awarded to Raytheon Co., 1000 Main St., Lexington, Mass.—02178, for the design, development, and construction of a radio for use in the field. The contract is for a total of \$1,000,000, with a maximum of \$1,000,000.

Manpack Radio—The contract, awarded to Raytheon Co., 1000 Main St., Lexington, Mass.—02178, for the design, development, and construction of a radio for use in the field. The contract is for a total of \$1,000,000, with a maximum of \$1,000,000.

Manpack Radio—The contract, awarded to Raytheon Co., 1000 Main St., Lexington, Mass.—02178, for the design, development, and construction of a radio for use in the field. The contract is for a total of \$1,000,000, with a maximum of \$1,000,000.

Manpack Radio—The contract, awarded to Raytheon Co., 1000 Main St., Lexington, Mass.—02178, for the design, development, and construction of a radio for use in the field. The contract is for a total of \$1,000,000, with a maximum of \$1,000,000.

Manpack Radio—The contract, awarded to Raytheon Co., 1000 Main St., Lexington, Mass.—02178, for the design, development, and construction of a radio for use in the field. The contract is for a total of \$1,000,000, with a maximum of \$1,000,000.

Manpack Radio—The contract, awarded to Raytheon Co., 1000 Main St., Lexington, Mass.—02178, for the design, development, and construction of a radio for use in the field. The contract is for a total of \$1,000,000, with a maximum of \$1,000,000.

Manpack Radio—The contract, awarded to Raytheon Co., 1000 Main St., Lexington, Mass.—02178, for the design, development, and construction of a radio for use in the field. The contract is for a total of \$1,000,000, with a maximum of \$1,000,000.

Manpack Radio—The contract, awarded to Raytheon Co., 1000 Main St., Lexington, Mass.—02178, for the design, development, and construction of a radio for use in the field. The contract is for a total of \$1,000,000, with a maximum of \$1,000,000.

Manpack Radio—The contract, awarded to Raytheon Co., 1000 Main St., Lexington, Mass.—02178, for the design, development, and construction of a radio for use in the field. The contract is for a total of \$1,000,000, with a maximum of \$1,000,000.

Manpack Radio—The contract, awarded to Raytheon Co., 1000 Main St., Lexington, Mass.—02178, for the design, development, and construction of a radio for use in the field. The contract is for a total of \$1,000,000, with a maximum of \$1,000,000.

Manpack Radio—The contract, awarded to Raytheon Co., 1000 Main St., Lexington, Mass.—02178, for the design, development, and construction of a radio for use in the field. The contract is for a total of \$1,000,000, with a maximum of \$1,000,000.

Manpack Radio—The contract, awarded to Raytheon Co., 1000 Main St., Lexington, Mass.—02178, for the design, development, and construction of a radio for use in the field. The contract is for a total of \$1,000,000, with a maximum of \$1,000,000.

Manpack Radio—The contract, awarded to Raytheon Co., 1000 Main St., Lexington, Mass.—02178, for the design, development, and construction of a radio for use in the field. The contract is for a total of \$1,000,000, with a maximum of \$1,000,000.

Manpack Radio—The contract, awarded to Raytheon Co., 1000 Main St., Lexington, Mass.—02178, for the design, development, and construction of a radio for use in the field. The contract is for a total of \$1,000,000, with a maximum of \$1,000,000.

Manpack Radio—The contract, awarded to Raytheon Co., 1000 Main St., Lexington, Mass.—02178, for the design, development, and construction of a radio for use in the field. The contract is for a total of \$1,000,000, with a maximum of \$1,000,000.

Manpack Radio—The contract, awarded to Raytheon Co., 1000 Main St., Lexington, Mass.—02178, for the design, development, and construction of a radio for use in the field. The contract is for a total of \$1,000,000, with a maximum of \$1,000,000.

Manpack Radio—The contract, awarded to Raytheon Co., 1000 Main St., Lexington, Mass.—02178, for the design, development, and construction of a radio for use in the field. The contract is for a total of \$1,000,000, with a maximum of \$1,000,000.

Manpack Radio—The contract, awarded to Raytheon Co., 1000 Main St., Lexington, Mass.—02178, for the design, development, and construction of a radio for use in the field. The contract is for a total of \$1,000,000, with a maximum of \$1,000,000.

Manpack Radio—The contract, awarded to Raytheon Co., 1000 Main St., Lexington, Mass.—02178, for the design, development, and construction of a radio for use in the field. The contract is for a total of \$1,000,000, with a maximum of \$1,000,000.

PROBLEMATIC RECREATIONS 142



Find 1000 consecutive telephone numbers.

—Continued

Our Guidance and Control Systems Division seeks electronic engineers with software equipment experience to design digital computers for military aircraft. The job calls for rapid design which we encourage. If you quickly and easily to innovate in the computer design area, a logical move would be to send your resume to Mr. Donald P. Kousar.

ANSWER TO LAST WEEK'S PROMISE: Exactly 600 yards it can be shown that in any general triangle the shortest line dividing it is two equal areas is equal to $\sqrt{2} (1 + \sqrt{3}) (1 - \sqrt{3})$, where $\sqrt{3}$ is the square root of 3, and $\sqrt{2}$ is the square root of 2. The force will be available in the two longer sides.

An Equal Opportunity Employer

LITTON SYSTEMS, INC.
Guidance and Control Systems Division
Woodland Hills, California

HOW BIG?



Manpack Radio

Manpack radio, weighing 7 lb. and adding 100 lbs. to the aircraft, provides portable communication for the military. The radio is small enough to be carried by a single person.

The radio is small enough to be carried by a single person. It is small enough to be carried by a single person. It is small enough to be carried by a single person.

The radio is small enough to be carried by a single person. It is small enough to be carried by a single person. It is small enough to be carried by a single person.

The JetStar is small enough for low-cost operation and maintenance. Big enough to give a crew and 8 passengers stand-up room. Powered by 4 turbojets.

LOCKHEED JETSTAR the compact utility jet



UKRAINIAN CROCHKOLOVARIAN MORAVA 200D (revolved 1400) were down the production line at the National Aircraft Works in Kyiv. Findings a different non-synthetic structure, Aircraft is considered under CAR Part 1 (Category N).

Aviation Week Pilot Report:

Morava 200D Has Rough Field Capability

By Robert J. Coleman

Benzo-Czechoslovakian's successful flight tests, the Morava 200 series has been scaled up to extend its capabilities as an air taxi that can operate in rough fields in the Soviet Union and in emerging Asian markets.

But at the same time, during a period when the Czech aircraft industry is displacing work on business planes (AVF Oct. 11, p. 125), the Morava 200D, the newest three-bladed propeller version, also is being pushed as a western export item to win foreign currency for the nation.

Because of its success with Aeroflot, the Soviet airline, and CSA, the Czechoslovakian airline, the Morava 200 design, Lladislav Benisek, put in considerable work on building a tailfin-mounted version. However, in line with

the new policy, this project has been dropped as too expensive for an airplane which did not really fit the rugged open-market business.

The Morava 200D now is being phased into CSA as two schedules and about 37 will be assigned to the airline by the end of the year. They are operated as regular schedules, chartered for tourism and sporting parties, and used extensively in air mail deliveries to Czechoslovakia's remote health spas in the Tatras Mountains, according to Petr Kersik, chief sales officer.

Benisek, who does considerable scheduling work, said at present operational runs on the Morava 200D last average about three hours per day. CSA plan to do stretch the figure to ten hours daily, where the two domain operators in the field as a civil service that normally is not considered feasible.

As an example of the teamed effort to make the two service profitable, Benisek scheduled two Morava 200Ds as night-swinging airplanes during the annual Rome International Trade Fair, flying them on 15 runs, eight in the standard Rome area. Charge for the flight was about \$2 per passenger. On the last day alone, the airplanes made about 70 trips, carrying three and four passengers at a time. Other airplanes, meanwhile, Benisek's Prague/Rome route in tandem with CSA's Jato 14, the Jato/Dnipro 114 both under license, on both scheduled and charter runs.

The Morava 200D, flown by the Aeroflot Wings pilot from the Rome Sports Flying Club, could about eight miles west of the industrial city, is a pilot's airplane, easy to fly and forgiving on almost every flight area.

With CSA as its pilot Vladimir VLA

shored, the Morava 200D, registered as OK-BUHA and taken from CSA service for the flight, was taxed at speeds up to 40 mph over wings, gusts high. Control response was immediate and firm even could be made at relatively high speeds without danger of dragging a wing as happens in a popper.

VLA pointed out that the main reason for the popper change, a V-180 steel, hydroforming prop made by Avia, was to in effect lift the landing higher off the ground for Soviet operations into fields that often have 2-3 ft of snow. Morava 200A models were fitted with two-bladed Avia 6 ft 5 in. propellers that folded in this type of landing area duties.

Propellers are driven by two Walter M-117 air-cooled, 18-hp inverted engines which incorporate low pressure direct fuel injection before the inlet valves. Engines, which produce 350 hp each, also include a disposable maintenance supercharger.

Morava 200D cockpit can be entered from either side through wide doors, not compartment seats three persons comfortably and interior on OK-BUHA was both solid and well-constructed. Side visibility is excellent but forward visibility for pilots leaves something to be desired. Windshield is split by structural line running from nose to top fin, and large square cockpit is hung from this structure, windshield frame being on either side also obvious visibility. In addition, on this model, an altimeter, barometric gauge, a glass engine device about 80 in. long, now fitted on other plans on the company's side.

A further cockpit complication for a pilot new to the airplane was the fact that instrument readings were in a mixture of Russian, French and German. Most Czech speak the latter language, and Czechoslovak instrumentation had been recently added for demonstration trips to Africa. Radio package was a Russian pushbutton VHF unit.

Starting is simple, since Morava designers have adopted the pushbutton technique wherever possible. Master switch and both magneto are pushbutton, as are starter buttons for both engines. Start was accompanied by warning on horn pump. In pushbutton, and letting master battery also master and ignition switches had been activated. Internal battery power (24 v) was used for this flight, although provisions have been made for external power units.

Supercharger was engaged for starting and then disengaged when engine reached 1,000 rpm for warming. Magneto are checked at 2,300 rpm, to disengage the magnets before, and watching for a 50 rpm maximum drop. Pitch control also is by pushbutton.

To facilitate the rough field routine,



MORAVA 200D features a three-bladed propeller, is offered in four color combinations.



SOVIET UNION'S Aeroflot will take delivery on 10 200Ds for use in its fleet. Instrument panel, below, makes extensive use of pushbutton. Note 16-colored Keros VHF radio.





V/STOL
AIRCRAFT



ELECTRONIC
NAVIGATION



TARGET/DRONE
SYSTEMS



FLEX WING
VEHICLES



SPACE
STRUCTURES



AIRFRAMES/
COMPONENTS



RADAR
ALTIMETERS

ADVANCED
METAL PRODUCTS

*The solution to many space
age problems lies within*

Ryan's spectrum of capabilities

These notable breakthroughs by Ryan scientist-engineer teams, demonstrate proven capability to create the necessary technology and to manage every phase of new, complex systems.

- Design, build and fly the world's first jet VTOL airplane. Then apply over three million man hours of VTOL experience in creating such modern aircraft as the Army's VZ-8 Jet Fan Aircraft.
- Take a concept like the Bagault wing and develop a successful test-bed vehicle with broad applications—the Ryan Flex Wing.
- Reverse the C-130 Douglas principle into world leadership in the production of electronic navigation systems for all types of aircraft now flying or projected.
- Develop complete jet target systems like the famed Ryan Firebee—most widely used target jet in the free world.
- Design and fabricate radar altimeters, precision antennas and space structures for such advanced space vehicles as Minuteman II, Saturn, Surveyor.

From advanced astronautics to the fabrication of space age metals, Ryan is prepared to assist government and industry in early studies, design, development, production, and the field support of complete operational systems and equipment.

RYAN AERONAUTICAL COMPANY, SAN DIEGO, CALIFORNIA

RYAN
AERONAUTICAL COMPANY



DALMO VICTOR MEASURES THE "MISS" IN MISSILES How close does an attacking missile approach a target? Dalmo Victor's non-cooperative Distance Measuring System gives a continuous digital readout of the range—across to the foot! Typical of Dalmo Victor's microwave versatility is this company-sponsored research and development project. The DV concept uses high resolution pulse radar techniques—with both the transmitter and receiver housed in the target. Not only is this new system important for missile evaluation and scoring, but its accurate range measurements also offer important advantages for satellite rendezvous, orbital docking, lunar landings and other sophisticated space operations. □ Microwave systems are another example of Dalmo Victor's project capabilities. DV is in the vanguard of the new developments in our major product areas. If you are interested in becoming a part of these challenging programs, Dalmo Victor currently is seeking applications from qualified scientists and engineers. For further information contact: Director, Scientific and Engineering Personnel.

DALMO VICTOR COMPANY 1111 INDUSTRIAL HWY. • BELMONT, CALIF.



A TESTCORP COMPANY

CAREER OPPORTUNITIES IN THE 5 AREAS OF DALMO VICTOR SYSTEM CAPABILITIES

The emphasis on development in each of the following areas offers a unique challenge. Dalmo Victor's contributions in five broad areas of specialization offer career opportunities in areas of vision, imagination and skill.

1. AIRBORNE ANTENNAS Important this is the location of operation of both radar and electronic warfare systems. One such high performance antenna package for search and track, forward airbase ground mapping, line oriented and a broad range of other projects.

2. AIRBORNE TRACKING SYSTEMS Airborne ground-based command and control systems provide tracking of various targets for vehicles, weapons, deep space penetrators. Dalmo Victor has the capabilities of producing accurate displays, from basic design to operation.

3. MICROWAVE SYSTEMS Dalmo Victor has been deeply involved in microwave systems for many years. Leadership has been exhibited in telemetry, automatic tracking, communications, and distance measuring with capabilities for satellite rendezvous and orbital docking techniques.

4. MAGNETIC SYSTEMS Another Dalmo Victor achievement area, including such unique developments as self-aligning and vectoring systems and space vector stabilization and attitude control systems, and other contributions in mag rifles, and in related fields.

5. GROUND SUPPORT EQUIPMENT In cooperation with Defense Technical Systems, another Testcorp company, Dalmo Victor supplies wide range of ground-based and ground control equipment, from a highly integrated combination of facilities and controls. Dalmo Victor provides important single-source responsibility.

The page opposite describes one of the many Dalmo Victor achievements. Study and expand on several entry-level positions to further this and other Dalmo Victor interests. If you would like to learn more about our company, and enjoy the many advantages of living in the San Francisco Bay Area area, investigate a career with Dalmo Victor. It can be most rewarding.

Q. An Equal Opportunity Employer. □



MORAVA 200D equipped for air combat was never before in a single aircraft. This is a single-engine aircraft, but a number of the type is in operation. Engine compartment is behind rear seat in passenger version.

Morava 200D's nosewheel is steerable from the cockpit pedals. Landing gear is hydraulically operated and a warning horn sounds if throttle is retarded with the gear in an extended position. Nose gear is steerable through 90 deg and hydraulic includes a shanty damper and light.

Flight Characteristics

For takeoff, there are at 15 deg and supercharger is engaged. Actual takeoff run, even for rough ground conditions, was about 150 yards and V_{LO} performed at under "back-seat" conditions, mostly using the rudder for directional control. Climbout was about 600 fpm at 90 mph.

Flight sampling was conducted near the city of Reno after this pilot had been through a flight test. From the beginning of the Reno military airport, base was for about 16 miles to get to the base of the Colorado River at three. Some approach to be on short takeoff but most problems are used for local training places of Colorado for base pilot training, now becoming a familiar sight in Colorado.

Morava 200D has very flexible stall characteristics. In "normal" climb a configuration, gear and flap up, the aircraft stalled at about 60 mph. Reaction in stall, banking, turning, yawing, and then an almost straight-ahead stall. Reaction is similar with gear and 18 deg of flap extended, with exception of a tendency for the Morava 200D to drop off slightly on the unstalled wing. Stall speed was about 55 mph.

Design philosophy was to build a weak structural strength as possible into

the airplane with a high degree of aerodynamic safety, in keeping with its stall fold nature. This is best demonstrated in single-engine operation, with the unstalled wingfold, but stall, airspeed dropped off rate 10 mph, and only manual reaction was slight sudden pressure. Morava 200D was could be flown in a 30 deg bank to the right, with the dead engine, with only a little additional use of rudder to hold altitude, again with no appreciable loss of airspeed.

Roll with the right engine feathered was sharper and right wing fell off quickly, but recovery was accomplished by opposite rudder and slight aileron pressure, after dropping the nose to regain control. Although less was less than 100 ft. As in other stall conditions, changes of time are small and can be controlled with one hand. In single engine flight, however, maneuvering requires a 18 deg bank into the operating engine.

Returning to the Reno airport field, V_{LO} demonstrated high maneuverability of the Morava 200D by executing a lightning "jet-on" approach, the

Morava 200D

Length	21.1 ft.
Height	7.4 ft.
Wingspan	19.4 ft.
Wing area	181 sq ft.
Empty weight	2,085 lb.
Gross weight	2,200 lb.
Maximum gross weight	2,200 lb.
Power	1,465 hp.
Wing loading	21.13 lb./sq ft.
Minimum level speed	180 mph.
Cruise speed	185 mph.

PROFITS

Grow
IN

PENNSYLVANIA

KEYSTONE OF INDUSTRY

Here's why MORE AND MORE COMPANIES ARE FINDING IT PROFITABLE TO BUILD OR EXPAND IN PENNSYLVANIA

Favorable Tax Climate

There is no Property Tax on manufacturers' machinery, equipment or inventory. . . and the state taxes no tax on real property. Moreover, taxing capital and equipment also exempt from both Capital Gains Tax, Franchise Tax, and from the Sales and Use Tax. No Block Transfer Tax, nor Personal Income Tax.

Skilled Labor Supply

With its long history of industrial leadership, Pennsylvania has a big reserve of skilled labor in every field—ready and available to any new products or techniques.

Major Market Accessibility

Pennsylvania is literally the keystone of the country's most populous group of states, and strategically located to serve the major markets for every conceivable type of product. Rail, truck and express facilities are excellent—and a vast highway system provides quick and easy access to all major distribution points.

100% Financing

The "Pennsylvania Plan" offers 100% financing on lease or lease-purchase of plant facilities. Among the participants in Industrial Development Authority have made 252 plant loans, totaling \$31,136,800—to build or expand plants saving an investment of \$10,241,181.

Get all the facts about the exciting future of business in Pennsylvania. Write for your copy of "Pennsylvania's Great Location Services."

Just a few of the growing industries in Pennsylvania:



Petrochemicals



Office Equipment and Business Forms



Electronics



Mobile Homes and Trailers



Wood and Paper products



Food, Chemicals and Drugs

ing the aircraft to a speed of about 200 mph and then breaking sharply left at about 18 ft altitude. G-ear was dropped at about 400 ft and the airplane went into a diving turn, with flaps lowered to 30 deg. for the final approach. Airplane touched down at about 50 mph on rough ground and NVA passed on the tarmac. Landing roll was about 230 yards.

In a nose rotation landing the procedure is similar with speed lowered to 150 mph on downwind leg, gear lowered, and flaps lowered to the recommended 10 deg. after establishing the final approach. Race with little use of brakes, the landing roll was short.

Mooney 200 features two reds, although total weight now has been kept small, partly to reduce the height of the aircraft for rough fields. Vertical tail surfaces are attached to horizontal stabilizer at points where they utilize most of the structure.

All-Metal Wing

Traycolod wing is all-metal and includes the ducted, reversed extending flaps. Wing also contains auxiliary fuel tank, main fuel tanks are the wing tanks, which hold 90 gal. each. An additional 42 gal. is contained in the fuselage. Precision control box is used for fuel transfer, and each engine can be fed from either main tank.

Wing leading edge is double skinned and hot air is bled from the engines for de-icing.

United Supplies distributor for the Mooney 200D, Peter S. Clifford & Co., Ltd., has sold two airplanes to private owners in Britain. Export costs of the aircraft, without complete radio package, is \$45,716.

Basic price, however, includes full cockpit instrumentation.

Southwest Facility

Pt. Worth—Investment of \$250,000 is planned by Southwest Airlines Co. as a facility at Ft. Worth Meacham Field.

Southwest Airlines' interest with the City of Ft. Worth aids in its to expand base facilities in rapid development, but the airline company says it probably will spend closer to \$150,000 in the first year of operation, including construction of a brand 100,000 sq ft and underground fuel tank farm, including a new facility and purchase of fuel trucks and aircraft ground service equipment.

Company plans around-the-clock maintenance personnel after its Love Field operation, and has leased 300,000 sq ft of space for aircraft parking and tie-down. Nonexclusive fuel sales agreement has been negotiated with the city, which had harbors conducted this service.



DELIVERIES WILL BEGIN in January of the new Mooney Master, lowest version of the Mark 21, featuring fixed-翼 leading gear and smaller cabin furnishings, but otherwise identical to retractable-gear airplane. Mark 200 Master leading gear is convertible so that owner may later have it modified to be retractable at cost of \$1,600. Master will list at \$13,995 in basic configuration.

Mooney Displays Two New 1963 Models

By Edwin J. Dolan

Kennett, Tex.—Mooney Aircraft, Inc., recently produced its 1963 line of light aircraft and simultaneously unveiled its future expansion plans.

New airplanes to be shown the company's distribution-dealer expansion plans in coming months are:

• **Mark 200 Master.** But addition to the company model line, which since 1955 has consisted of one airplane, which has evolved into today's Mark 21. Although basically a modification of the Mark 21, the new Master is a Mooney aircraft to broaden its market by developing a lower cost version for training, charter work and as a means of introducing "beginner" pilots to the line who feel that they are not ready for retractable leading gear. The Master is Mooney's answer to the Piper Cherokee and Beech Musketeer four-place fixed-gear lightplanes.

• **Mark 21** for 1963, refined in detail, with price unchanged from last year, will continue as the company's mainstay. Mark 20C is the technically new but designation for the four-place retractable tri-cycle gear airplane which the company has renamed the Mark 21 in its presentation since changeover to all metal structure in 1961.

Mooney's plans for introducing its models to its field sales organization will be three separate, theoretical distribution dealer meetings. After these meetings, the company will be able to plan production schedules for the Mark 20D

Master based on the backlog of orders. Deliveries to distributors are to begin by June.

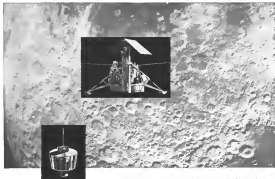
Mark 200 Master basically is a Mark 21 with fixed leading gear and long-planned interior and equipment. Basic price is \$13,995. Mooney says it developed the airplane as a result of distributor requests for a second airplane that they could use for training

student pilots and prospects at lower cost.

Quicker selection, as the company saw it, was to take the Mark 21, make the leading gear so that it was fixed and deliver standard instruction machines. This also provided the firm with an interesting possibility—that of providing a modification kit so that a Master owner could later have the airplane



DUAL CONTROLS are shown in new Master, which also features simplified instrument panel. Interior furnishings also are more modern than Mark 21 to keep price down.



systems analysts:

Quantify the complex on important projects at Hughes!

One of the best ways to experience
HUGHES
is to see a rocket launch
HUGHES AIRCRAFT COMPANY
AEROSPACE DIVISION



SURVEYOR (soft lunar landing spacecraft), **SYNCOM** (synchronous communications satellites), **VATE** (automatic test equipment) and ballistic missile defense systems (coastal intercept, mid-course, terminal—these are a line of the many projects) and complex projects under design, development and study at Hughes. Because of these projects and others important to the nation's defense, progress and space effort, Hughes offers many opportunities to Systems Analysts than ever before!

Involved with these problems are the solutions of many basic problems such

as the proper mix of manned vs. unmanned satellites, the requirements of manned space flight (R systems support needs for high speed strike reconnaissance systems or unmanned satellites, analysis of escape systems from capture through development, test and customer use, and many others.

Requires background: If you are a graduate engineer or physicist from an accredited university, a U.S. citizen, and believe that you can contribute to and benefit from the important projects at Hughes, contact us today. Attach your resume to:

**Mr. Robert A. Merila,
Head of Employment
Hughes Aerospace Division
1401 W. Jefferson Blvd.
Gulfer City 73, California**

We promise you a reply within one week.
An equal opportunity employer.



SAFETY

Blast Caused Continental B-707 Crash

On the night of May 22, 1962, a Continental Air Lines Boeing 707-320, N7 70771, operating as Flight 11, en route from Offshore Airport (Chicago, Illinois), to Kansas City, Mo., via Springfield, Ill., crashed at an altitude of 10,000 ft. A few minutes after Flight 11 had made a normally elevation turn course to circumnavigate a thunder storm in the vicinity of Centerville, Mo., the outer wing of the aircraft disintegrated from the wings of the aircraft, lost Flight Following Service. At approximately 2117, an explosion occurred in the right rear fuselage resulting in separation of the mid section from the fuselage. The aircraft broke up and the main part of the fuselage struck the ground about 4 mi. south-southwest of Centerville, Mo. All 17 passengers and crew at a sustained fatal injuries. The aircraft was totally destroyed.

The final conclusion that the probable cause of the accident was the disintegration of a dynamic explosion which occurred in the right rear fuselage, resulting in destruction of the aircraft.

Investigation

Accident N 10775, a Boeing 707-320, N7 70771, as noted at Offshore International Airport, Chicago, Illinois, from Los Angeles, Calif., as Continental Air Lines Flight 10 at approximately 1900 on May 22, 1962. At 0100, the aircraft received immediate servicing and a terminal inspection in preparation for scheduled departure to Los Angeles. Flight 11 with an enroute stop at Kansas City.

The crew of Flight 11 had been into Offshore International Airport, the crew of C-141, Flight 4, a Boeing 707, landing there at 1915. The crew consisted of Captain Fred B. Ginn, First Officer Richard J. Sullivan, Second Officer Roger D. Allen, Doctor of Aerospace Medicine, David E. O'Connell, and Aerospace Medicine, Mary McQuill, Martin Rade, and Betty Perry. Flight 11 was accompanied by the flight instructor of the center headquarters in Denver through the enroute service area at Chicago in accordance with company policy and procedure. The dispatcher's enroute flight plan course cleared at 20,000 ft. from Chicago to Kansas City was changed to 20,000 ft. by the captain because he had knowledge of thunderstorm activity west of Chicago. At enroute time of 1:00 hr. from Chicago to Kansas City, the crew was on the flight plan. Flight 11 was entered from Offshore with a 1000 ft. gross weight and a center of gravity well within prescribed limits.

U.S. Weather Bureau forecasts indicated thunderstorm activity associated with an active cold front and surface squall lines between Chicago and Kansas City. A severe weather warning was in effect for an area which lay across part of the proposed route of Flight 11, predicting heavy thunderstorms between 1000 and 1500 ft. south.

U.S. Weather Bureau forecasts indicated thunderstorm activity associated with an active cold front and surface squall lines between Chicago and Kansas City.

were to enhance turbulence and possibility of separation.

Flight 11 reported off Offshore Airport at 2015 and was vectored by dispatchers cleared at 2000, 17, reporting over Redford at 2030 to enroute 20,000 ft. At 2032, just east of the Mississippi River, at approximately 2114, Flight 11 noted the crew was in Traffic Control Center. It had a radio picture of the squall line just ahead of the flight. The squall was intense and the control believed the flight was in the flight following radar site at Wichita, Mo. one minute later. At about 2102, Flight 11 reported vibrations regarding separation of the main wing and the fuselage. The vibrations suggested a severely commencing of a disintegration lying across the aircraft's flight path.

Additional discussion between Flight 11 and the controller developed that the fact that the thunderstorm could be circumnavigated rather to the south or to the north. The controller's discussion indicated that the aircraft's radio was operating satisfactorily and Flight 11 cleared to pass to the north around the storm cell. After the aircraft passed around the storm, the controller informed the flight that a direct course to

Wichita from its present position should avoid all turbulent weather. The crew then replied that they were clearing a turn, and requested clearance direct to Kansas City. The controller advised the flight that direct clearance was being processed.

For several minutes Wichita attempted to contact Kansas City Center, without success, and to instruct the flight, whereupon Flight 11 replied "Copy, we are probably south there on our route, do you want to see us over?" The fact that the clearance was issued from Flight 11 and is believed, by the controller, to have occurred at approximately 2114. Wichita apparently was unable of the transmission. However, the Wichita controller established contact with Kansas City Center and attempted to direct a radio transfer of Flight 11. At the same time Wichita tried unsuccessfully to contact Flight 11 to report that they could communicate with Kansas City (1155) enroute. Wichita also attempted to identify the Kansas City Center the radio transfer location of Flight 11 at about 10,000 ft. at the intersection of low-level HAY and 300V, and clearing in a southward direction. The Kansas City controller man-



C-133 Undergoes Pressurization Test

Douglas C-133 is scheduled for a helicopter test tank for pressurization testing during several months USAF fatigue research program. Aircraft recently completed the equivalent of 30,000 hr. flying time, during which the aircraft sustained 15,000 sustained flights. Tests were conducted at Douglas Aircraft Co.'s Long Beach, Calif., facility. Only one crew member in the tank, all reusable, developed during the test period which included pressurization, loading, taxiing and gear loadings on landing wings, empennage and landing gear. Air Force may extend the test to 60,000 sustained hours.

observed as indicated target at this approximate position but this target did appear after two or three sweeps of the infrared and was never visible for radar bandwidth purposes. The Wrecksite Committee stated that at approximately 2113, one man after Flight 11's last transmission, he observed the aircraft's inoperative return and subsequently the person target began to fade from the radar scope. It was later determined that the aircraft had crashed 6 mi south-southeast of Unsworth, Missouri.

Numerous people in the vicinity of the aircraft site were contacted during a search for eyewitnesses to the incident but none could be found who could positively confirm what they saw with the Conquest aircraft. Several persons in the vicinity of Concrete Area and Unsworth, Missouri heard loud and unusual noises. Two witnesses saw a big flash or ball of fire at dusk develop in the sky. The times at which these phenomena occurred were estimated by witnesses to be between 2103 and 2150. All witnesses stated that the weather was clear at the time.

A B-47 from Forbes AFB, Topeka, Kan., was flying in the vicinity of Ballwin, Missouri at the approximate time of the accident and was headed to a northerly di-

rection at 36,500 ft. The aircraft commander later reported that he saw a bright flash in the sky forward of and above his position. After referring to his navigation log he estimated the flash to have occurred at 2113, near the location where the last radar target of Flight 11 had been seen by Wrecksite. He further stated that weather in the area at the time was clear with little or no turbulence.

Flight Recorder

The last message received from N70779's flight recorder showed little damage, but there was extensive damage to its recorder tape. Areas downstream of the message bracket, and considerable damage to the internal mechanism. All of the parameter values recorded on the last tape available and showed a normal operation of the aircraft. These values closely correlated with the aircraft's reported flight profile from lift-off at O'Hare Airport until 42 min later, when the vehicle's acceleration trace indicated extremely large increases and all other items became unreliable. The recorder indicated that the aircraft had encountered moderate turbulence at several intervals throughout the flight but that for about five minutes prior to the last signal

from the air was smooth. Correlations of the flight recorder readings with the reported radar data indicate that at 2111, on re-examination of the last applicable behavior, the aircraft turned from a magnetic heading of 278 deg. to a heading of 247 deg.

It held this heading for about 30 sec., and then turned further left to 130 deg., holding within 10 deg. of the latter heading from approximately 2113 to the point where the trace became abnormal. The pressure altitude trace indicated a normal descent, from 70,000 ft., was begun at approximately 2115 and it continued at a fairly constant rate of 3,000 ft. per minute for 2 min. 7 sec. to an altitude of 36,500 ft. The calibrated airspeed trace during the same interval of time shows an unsteady increase from 230 to 274 kt. The acceleration trace for this period of time shows little from 1 G except for a 6-sec. interval in about 2116, when it jumped slightly between 0.25 and 1.25g. Approximately one minute later, approximately 42 min after lift-off as at approximately 2117, the flight recorder trace became extremely erratic.

The heading of N 70779, against the aft 10 ft., and with part of the tail end most of the right wing missing, struck the ground, headed westerly down a 30-deg slope of an

alluvial field located about 6 mi north-southeast of Unsworth, Mo. and 15 mi west of State Highway No. 5.

The nose of the aircraft dug into the ground at a 30-deg angle with some subsidence of the landing gear 40 ft of the cockpit, however, the remaining fuselage of the aircraft, including the main wing, the tail, landing gear, and tail rotor, struck the ground in a nose-down attitude and with the left wing almost level. There were indications of rotation about the vertical axis at impact but the absence of drag made down the tail indicated an almost complete lack of horizontal speed. The landing gear was down and behind the wing fins were up. An unexploded parachute was found between the cockpit's intake and the instrument panel.

The flight deck lights had stopped at 2113.15 and 2113.45, respectively. The engine nose hood at first opened, but then within an hour it was closed and it was long with the closed engine opening. It is not clear if the nose wing, up. Each engine was partially buried in the ground on impact from an almost vertical fall. Inspection of the engine indicated that there was little or no rotation of compression or turbine at ground on

Two large pieces of the aircraft were scattered in a southeasterly direction along the aircraft's flight path 4 to 41 mi from the main wreckage. One of these a 20-ft section of the left wing, was found about 4 mi from the outboard panel and tip of the left wing were found 28 miles southeast of the main wreckage. The forward stabilizer and elevator assembly was lying in a field about 1/2 mi south of the 28 ft wing section. About 6 mi southeast of the main wreckage the vertical fin and stabilizer assembly, with about half of the stabilizer 1440 and 1567 frames and some top skin still attached, was found either having dropped almost vertically into the ground.

Airframe Marks

A non-vented "head" handle from one of the engineer's harnesses, a pillow, and some items, paper were found lodged inside an aperture between the dome 1440 frame and the skin. A small amount of blood and other human wastes were found on the aft surface of this frame. Numerous shoe sole marks and several panty marks were found on the surface of the fin. There were also elements on the right horizontal stabilizer with blue marks matching color control components.

Fragments of the airplane were scattered along a compass path 80 mi long in a north-south direction from the main wreckage. Low density materials such as paper, tape, pins, pillows and insulation were recovered at distances up to 120 mi from.

Examination of the wreckage showed no evidence of metal fatigue, structural or system failure or malfunction before flight, or release, with another anomaly in fatigue object. The condition and nature in which the wreckage was found indicated a high altitude breakup and disintegration of the aircraft in flight.

During the initial stages of the investigation, about 23 ft of the fuselage between stations 1220 and 1440 could not be found. An intensive search for the missing wreckage was conducted, all scattered wreckage including pieces of the main section, were reclassified at one location and this wreckage at the aft fuselage was soon discovered. One instance of the fuselage on horse from about 30 ft forward of the main wreckage due to the impaction, the entire wreckage of the section in the main ground area.

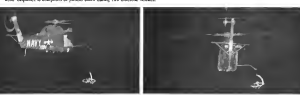
An intense and extensive search of the wreckage were related to their original position on the main wreckage it was found that



Helicopter gear is rescue equipment, developed by Kaman Aircraft under a \$109,000 Navy contract, successfully rescued a distressed rescue at night in moderately heavy seas about five miles off Block Island, N. Y. Wreck was about five feet high as helicopter moved in toward the subject. Kaman engineer in water apparently was unable to help himself. Above left, air pilot's view of cargo net in leading lights. Right, pilot looking in darkness at rescue net out on overboard area.

Ladle Net Helicopter Rescue Gear Scoops Immobile

Engineers in support units met by tactical actions of the helicopter, their lifted crew at water. Dismayed have been used for a number of the approximately 15 open sea rescue teams to date after it was found that live subjects tended to make an effort to assist the rescuers. Navy required rescue gear that could scoop unconscious or immobile persons from the water. Live subjects are pictured here. Sequence is composed of photos taken during two different rescues.



Cable, threaded through end of arm, leads net to water level. Net is some size in standard Navy rescue net, but effective area has been increased about 50% by use of ladle handle. Arm swings forward to pull on both persons in water and net at all times. Flipping Navy HUZB41 dip net below the surface and water forward and the net is below the person to be rescued. Thus the pilot rescues the helicopter's altitude. Hydrodynamic forces swing the ladle into away from the man.

Test Subject From Running Sea During Darkness

Ladle net is lifted to catch dark level by search-powered cable in water. Photo below. Arm then rotates around to bring net down behind the open hatch. From there can be pulled in by rescuers or can simply roll in. Rescuers have been used in daylight in 12 ft seas with winds up to 23 kt. Numerous subjects have been rescued in calm seas and rough. Gear now will be turned over to Navy for service collection. Photos were taken from an open power house.



When you follow these welding instructions— you can perform wonders with USS® "T-1" Steels

USS "T-1" Steel, and "T-1" type A, are two of the most versatile steels ever developed. They combine very high yield strength (100,000 psi minimum), outstanding toughness, and ready weldability. Designers have taken advantage of this remarkable combination of properties to build stronger, lighter structures of many types, and to improve the performance of an expansive array of heavy-duty equipment.

Achieving great strength and toughness in a steel is not an unorthodox quest. But combining these properties with weldability is, as in the case of USS "T-1" and "T-1" type A Steels. It is this weldability that permits the designer to take full advantage of the strength of "T-1" Steels.

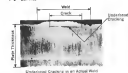
Being heat-treated structural alloy steels, USS "T-1" Steels require different welding techniques than other high strength steels. They are not difficult to weld, just different. Strong, reliable joints are obtained when the following three precautions are followed. We invite you to read them as a guide to realizing the full benefits of USS "T-1" Steels. They are detailed in a booklet which includes a Welding Heat-Input Calculator, too, and in our new welder training film, "How to Weld USS "T-1" Steels" (see coupon).

RULE 1—Use the proper electrode

When replacing arc welding "T-1" Steels, use only electrodes with low-hydrogen coatings. Or, use a welding method which is "low hydrogen" such as inert-gas shielded arc or submerged arc welding.

Hydrogen is the number one enemy of sound welds in "T-1" Steels, as in all alloy steels, because it causes underbead cracking, resulting in unreliable joints.

To be sure you have selected the correct electrode, remember that low hydrogen coatings are designated by the last two numbers of the electrode classification as 15, 16 or 18. None other. For example, E6015, E6016, and E7018 are satisfactory for welding USS "T-1" Steels.



Underbead Cracking in an Actual Weld

When you want to be positive that the finished weld will be as strong as the parent "T-1" Steel, use E7015, -16, or -18 rods.

Never use electrodes or wire flux combinations containing vanadium to weld "T-1" Steels if the weldment is to be stress relieved. Weld metal containing vanadium is likely to be made brittle by stress relief. (Stress relief is only necessary with "T-1" Steels when re-

quired by codes and one or two other special cases.)

When welding "T-1" Steels to a lower-strength steel, use low-hydrogen rods of the strength level recommended for the lower-strength steel.

Proper handling of electrodes is also important. When exposed to air, low-hydrogen coatings will pick up moisture which is a rich source of hydrogen. Keep your electrodes dry. Make it a practice never to open more than 30 minutes' supply of rods at a time. A sure way to keep rods dry is to keep them in a desiccator, 300°F even, if your rods are absorbed moisture, but bake them in an oven according to the manufacturer's recommendation. One hour at 300°F is average.

To sum up Rule 1, for manual welding use low-hydrogen electrodes and keep them dry. For submerged arc or inert-gas shielded arc welding, use thoroughly dry fluxes and water free shielding gases.

RULE 2—Use correct welding heat

On most kinds of structural steels, high heat input results in superior welds. With "T-1" Steels, just the opposite is true. The best welds in "T-1" Steels depend on never getting over a certain maximum amount of heat. Less heat is good so the weld will cool quickly which, in "T-1" Steels, results in good, tough welds. Thus, you must closely control the amount of heat put into the weld.

For this reason, never preheat "T-1" Steels except in special cases. Preheating means more heat is put in and a longer cooling off period, which can be harmful to welds on "T-1" Steels. The cases in which preheating is necessary are those in which the steel must be warmed to get rid of excessive moisture (in hydrogen control where the steel is so restrained it doesn't have room to shrink after welding, or when thick plates over 1" are being welded. Much of the time, however, preheating isn't necessary, and never preheat "T-1" Steels on hunch alone.

The heat you put into a weld depends principally on amperage and the speed at which the arc travels along the joint. The higher the amperage, the more heat input. The slower the speed, the higher the heat input. Controlling heat input requires keeping amperage below certain ceilings and keeping the speed of arc travel above certain speeds.

There are two other important items to keep track of: steel thickness and temperature. Thicker sections can safely soak up more heat than thinner ones, so you can use more amperage and slower speed. As for temperature, the section may have been heated up by preheating or by previous passes of the electrode. So if the section is already hot, you must cut down on amperage or increase speed to avoid excessive heat input.

Heat Input Calculator.

There's an easy way to determine the safe heat input for USS "T-1" Steels, the circular Heat Input Calculator which is provided with the book offered in the coupon. With it you can quickly find out what amount of heat will result from any given speed, and determine how much more you can safely put in, if it is a



circular "slide rule" which tells, on the front side, how much heat will be put into the joint if you know the amperage, voltage, and arc speed. On the back side of the calculator are tables showing the safe heat inputs for "T-1" Steels in several different thicknesses at different temperatures. This handy device is designed to help you get good welds every time. Heat inputs may also be calculated from this formula:

$$\text{Heat Input per inch} = \frac{\text{Amperes} \times \text{Arc Volts} \times 60}{\text{Speed, inches per min.}} \quad \text{Weld Speeds (inches)} \\ \text{Per inch of weld}$$

RULE 3—Use recommended welding procedure

The straightforward stringer bead method is preferred for welding "T-1" Steels. Do not use the "fish-tail" method. Weaving beads into the metal more because the arc travel speed is slower and may cause excessive heat input. The proper method is to fill the groove with a succession of stringer beads. Before a bead can be laid over an earlier bead, the fish scale, or carbide scale must be removed.

Back gouging. The preformed method is arc air gouging followed by clean-up grinding. Do not use an oxy-acetylene torch. There is danger of overheating which may cause an unsatisfactory joint.

Speed. Whether you control speed by machine or hand, control it closely. The Heat Input Calculator described above is your guide to the proper speed to avoid excessive heat input.

Fillet welding. Good fillet welding technique is more important with "T-1" Steels because the joints are usually required to withstand greater loads. Fillet welds in "T-1" Steels should be smooth, correctly rounded and well fused in to the legs of the joints to be joined. The layers of each weld should be made so that there is good root penetration but no undercutting. The weld shown on the left is ideal, the one on the right is to be avoided.



When thick plates are joined, and when the weldment is to be stress relieved, fillet welds can be troublesome because of toe cracking. There are several

ways to eliminate toe cracking: near fillet welds on "T-1" Steels in the case of Tee or T-joint welds lower strength welds are often the rule, use low hydrogen rods of the E60, E61, and E70 classes. Stress lower in strength and more ductile, they are less likely to "pull cracks" at the toe of the fillet weld.

Air hammer peening of the weld can also be very helpful in preventing cracks, especially if the weld is later stress relieved. Joints made even with the higher strength rods (E70, E81 and up) should be free from toe cracks if peened. Sometimes it is necessary to peen each pass, at other times, peen only the toe passes will prevent cracking. After peening, the fillets should be smoothly ground to fair the fillet into the legs of the joint.

Other methods that can prevent cracking include use of a soft wire peen, machine grinding the base of the upright girth, and laying down "butter" welds in low stress. The first two methods allow the upright leg to "sink down." The "butter" weld strengthens the "T-1" Steel in the area where a toe crack may start. It is ground off prior to actual fillet welding and must be laid on so that the toe passes of the fillet will be laid right over the strengthened area.

Free Welding Help.

The above information is spelled out in greater detail in our free book "How to Weld USS "T-1" and "T-1" type A Steels" is included in the book is a Heat Input Calculator. But before the welder shows the proper welding technique, we'd gladly furnish you free copies for your shop personnel. And, you'll find out, in 16 minutes, 16 other modern methods for the same work as they help demonstrate to your welders the proper techniques for welding USS "T-1" Steels. Send the coupon, USS and "T-1" are registered trademarks of United States Steel Corporation • Columbus-Genesee Steel Company • National Tube Division • Tennessee Coal and Iron Division • United States Steel Supply Division • United States Steel Export Company



United States Steel, Room 6421,
825 William Penn Place,
Pittsburgh 30, Pa.

Coupon:

- Please send me a copy of "How to Weld USS "T-1" Steels"
- Also send me your film on weld metal of the same name. I understand there is no charge.

Name _____
Title _____
Company _____
Address _____
City _____ State _____



This mark tells you a product is made of carbon, low-alloy steel

IBM Space Systems SPACE-WEST



A Space Systems Design & Development Group in LOS ANGELES and SAN JOSE.

Engineers, Physicists, Analysts, and Scientific Programmers are invited to explore dynamic career opportunities with IBM's Space-West team engaged in advanced systems design and development, including project management.

Space physics, modeling, optics, Mathematical model design, Mathematical & engineering analysis, Programming system analysis, Real-time & scientific programming.

Immediate interviews may be arranged in Los Angeles. Present staff includes several senior members of IBM's Project Mercury and related missile program teams. For further information, send relevant resume to:

J. V. Croker, Dept. 328X5
IBM Space Systems West
3428 Wilshire Boulevard
Los Angeles 5, California

Related assignments are also available with our Washington, D.C., area Space Systems group.

IBM Federal Systems Division
An Equal Opportunity Employer

the pieces became progressively smaller from 40 degrees down to a third-mile scale for right and leftward. Most of the pieces of the disintegration were more fragments of very easily melting. Looked at the disintegration of atoms and the rapid penetration of this structure and composition from almost negligible at high velocity concentrations of gas-like deposits applied under heavy thrust, several disintegrated straight not over two feet, and other such evidence clearly revealed that a high level determining there had occurred from the explosion. The physical evidence showed that this force had originated in the more toward the underside of the machine canopy of the right battery, and had acted in all directions from this point.

Chapman bodies were recovered from the main wreckage and were seen, based on various points from three to five of a mile to about ten miles back along the highway. One fragment in the main wreckage survived the accident but according to the report above about 11 he after his escape, which occurred several hours after the accident. The explosion first effect and second effect was as three several cross boundaries. These include mainly in the cockpit were found with his pilot disintegrated, except knee broken and with blood and tissue, adhered to the inside and outside of such work. Two colored and pathological examinations of the flight crew bodies showed an about similar. No evidence of bones was found on any of the bodies.

A review of the maintenance records of N-7373 revealed no significant irregularities prior to the accident. A departure from O'Hare Airport on the night of May 22, 1962.

Analysis and Conclusions

Regarding the operational and maintenance aspects of this accident the records show that the flight crew was properly qualified, that the aircraft was dispatched in accordance with company policies and procedures, and that the records were accurate at the time the flight departed from O'Hare Airport.

Statements made by witnesses positioned who had the aircraft take-off rule immediately during most of the flight, issues made by the aircraft flight recorder, and various documents regarding local weather conditions indicate that (1) it is through having out-of-control disintegration occur in flight, but had safety recommendations there and was in close vicinity conditions with no significant take-off rule when the disaster occurred. It is therefore concluded that weather was not a factor in this accident.

All available evidence indicates that the aircraft initial disintegration at an approximate altitude in the vicinity of 30,000 feet, and at a rate determined to be approximately 2100. This conclusion is supported by the University of Illinois research, which showed the aircraft's disintegration and primary body fragments to have been in scope at approximately 2100. Ground-based records in the vicinity of the land showed the aircraft was in a dash or ball of fire in the place of the true disintegration between 2100 and 2150.

The 3-97 pilot who was in flight in the sky encountered the time of the crash as being

2127. However, the most reliable evidence regarding the time of the explosion is not included in the data collected by the aircraft's flight recorder as being 2127.

The physical evidence showed that the landing gear was damaged and that the flight crew was wearing oxygen masks at the time of impact. In addition, the emergency check list was found between the captain's seat and his instrument panel. This evidence leads to the belief that upon experiencing an explosion, which would of course, he followed by engine disintegration, the crew initiated the emergency emergency disintegration. It is also thought that the crew showed similar masks due to the dense fog which filled in the cabin immediately after explosion disintegration.

A separation of the tail, the remaining aircraft section struck some down on the ground, causing the engine to rise into the air which it fell in a controlled position. After separation from the aircraft, the engine seemed a separation which allowed sufficient time for their ejection and failure to meet in a negligible rate before impact with the ground.

Reconstruction and examination of the flight recorder indicated that the force which caused the initial disintegration (which took place within the red line) was not sufficient to disintegrate in right or left direction. The causes of the explosion were clearly shown in the pattern of breakup and position of fragments scattering from the head zone. Such evidence was so deep situated in the damage caused by an explosion involving from any considerable scale or on some involved with the operation of the aircraft as witness or passengers. The Federal Bureau of Investigation (which has authority of evidence collected on control from the right side battery and as-



Rocket Ejection Seat

New model powered ejection seat developed by Martin-Baker Aircraft Co., Ltd., will be installed in F-105, F-117, Diamond Hawk and McDonnell Douglas F-4E. The F-117B Rocket, which represents the first of conventional gun allows a force to be reduced from 30g to about 15g.

IBM asks basic questions in space

Where will it be next?



This flying board, driven by an air computer, tells major space control personnel the exact location of the spacecraft (shown) at any time in its orbit.



Throughout each orbit flight, the major space control system continuously predicts the point where the spacecraft will eventually return to earth.

Managed satellite tracking requires up-to-the-second information. To tell us where a spacecraft is now and where we should look for a next, an on-board computer system in the NASA-Goddard Space Flight Center has been linked to ground tracking stations. This system contains sensors, real-time observation channels, data processors, and display units on information network. It can deliver data from space into continuous predictions of flight—from launching, through orbit, to impact.

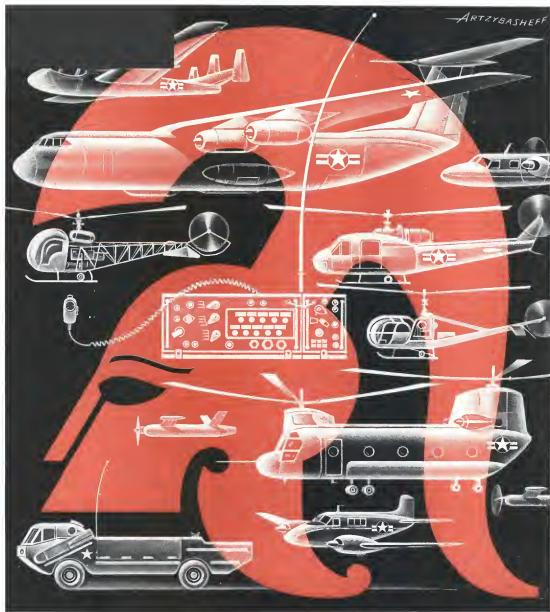
Space information systems must square thousands of complex computations into split seconds. To reduce computation time requirements, our engineers are investigating the application of advanced computing techniques—such as associative memory and auxiliary storage of precalculated data—to space systems. To enable tracking systems to operate in real time, they have developed special communications channels for major Mercury and other projects, speeding data into central computers and back to tracking stations around the world. In another area, under contract to the Radio Division of the Bendix Corporation, we have designed a data processing system for real-time control of an Electronically-Steerable Army Radar (ESAR). This new approach to handling data in radar systems makes it possible to switch the direction of radar beams with greater speed

than was possible by using mechanical methods—so that our radar can track many satellites and space vehicles simultaneously.

Tracking systems will improve as we learn more about space. Present atmospheric models are static. Their failure to reflect the ebb and flow in the density of the air forces us to approximate orbital perturbations due to atmospheric drag. By feeding data from satellites traveling through the atmosphere into an IBM 7090 computer at the Smithsonian Astrophysical Observatory, our scientists are plotting air density as a function of declination. The dynamic atmospheric model to emerge from their work will make predictions of space flights in the region lying between 150 and several hundred miles from earth more accurate. . . an important step toward the precise control needed for the space systems of the future.

If you have been searching for an opportunity to make important contributions in space, programming developments, manufacturing research, solid-state developments, or any of the other fields in which our scientists and engineers are finding answers to basic questions, please contact us. We are an Equal Opportunity Employer. Write to: J. V. Croker, IBM Space Systems West, Dept. 328X5, 3428 Wilshire Boulevard, Los Angeles 5, California.

OCT. 30 1962



For a complimentary reprint of this Artzybasheff illustration, write: Avco, Dept. AW2, 750 Third Avenue, New York 17, N.Y.

Centuries of history teach the importance of military mobility. And today Avco capabilities help provide it. Superstrong honeycomb structures for logistics aircraft—reliable engines for battlefield helicopters, aircraft, and drones—high-speed amphibious hydrofoil vehicles—advanced ordnance—push-button combat communications. These are important Avco contributions to today's vital mobility for defense.

UNUSUAL CAREER OPPORTUNITIES FOR QUALIFIED SCIENTISTS AND ENGINEERS REGARDLESS OF RACE, CREED, COLOR, OR NATIONAL ORIGIN... WRITE AVCO TODAY AVCO CORPORATION, 750 THIRD AVE., NEW YORK 17, N.Y.

Avco